Vol. 9, No. 10
May 31, 1984

Energy Research Abstracts

Abstracts 17916-19603

Technical Information Center
Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription as PB84-946800 from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic subscribers and $28.00 for subscribers outside the North American continent; prices for single issues are $7.00 and $14.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers. A single issue is $7.00 (domestic) and $14.00 (foreign).

***Current Energy Patents (CEP)*–PB84-902800**

Provides coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB84-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB84-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB84-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB84-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB84-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Coal-Based Synfuels (CBS)*–PB84-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB84-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB84-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Geothermal Energy Technology (GET)*–PB84-914700**

Devoted to information on the exploration, development, and utilization of geothermal resources.

***Laser Research (LAR)*–PB84-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB84-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

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Covers the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB84-902900**

Covers the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB84-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB84-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information, Technical Information Center (TIC) cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Office of Scientific and Technical Information, Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, Technical Information Center, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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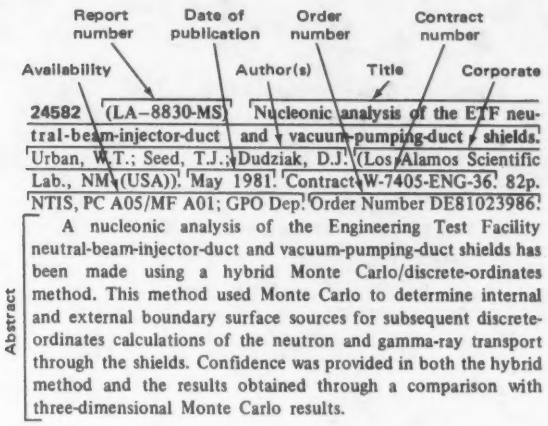
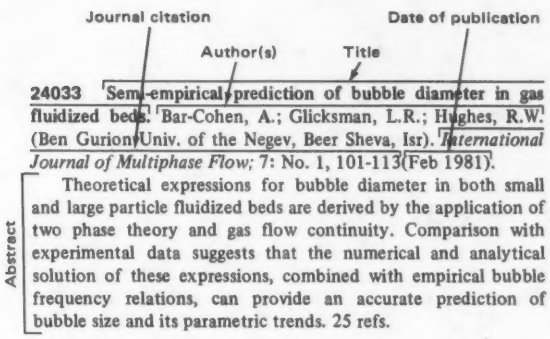
HOW TO USE *ENERGY RESEARCH ABSTRACTS*

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Order number
Contract number
Availability
Author(s)
Title
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE81023986.
Abstract
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Abstract
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
Neutral Atom Beam Injection
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)
Neutron Transport
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
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• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–		
8830-MS	**6:24582**	**NTIS, PC A05/MF A01; GPO Dep. Order Number DE81023986, Distribution Category STD-20d**

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 17969

17916 (ARL-TR—27) Development of an integrated research and development program on eastern Canadian coals. Abbott, D. (National Research Council of Canada, Halifax, Nova Scotia). 1981. 85p. (NRCC—19539). National Research Council of Canada, Halifax, Nova Scotia.

Coal production and use, R and D performers on eastern Canadian coals, coordination of an R and D program, technical problems of the coal industry and R and D requirements, and recommendations for a research and development program are described. (27 refs.)

17917 (DOE/FE/60339—2) High sulfur coal research at the SIUC Coal Technology Laboratory. Quarterly progress report. (Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center). 1984. Contract FC22-83FE60339. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84005719.

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The research effort addressed in this cooperative agreement includes the conduct of a high-sulfur coal research program and the establishment of a research facility, the Coal Technology Laboratory at the site of the former Carbondale Mining Technology Center. The associated research program is broadly based and directed toward high-sulfur coal, the goal being expand the technology to allow for the increased use of high-sulfur coal in an environmentally acceptable manner. Progress continues to be made on the research in the four areas of coal science, coal preparation, coal conversion, and coal utilization. In the Coal Science area, the maceral separation laboratory is about 90% operational. In the area of coal preparation, a mechanical auger feeder device for introducing material into an experimental hydrocyclone along its axis was constructed and incorporated. A froth flotation pilot plant has been acquired and renovated. Coal conversion studies included experiments to examine the effects of chemical pretreatment on supercritical extraction and desulfurization of coal. It was found that with pretreatment a high-sulfur coal containing predominantly organic sulfur experienced a 57% reduction in sulfur on a concentration basis. Without pretreatment, the sulfur reduction was only 40%. In the work examining the mechanism of hydrogen sulfide formation from iron sulfides, it was found that hydrogen sulfide is formed from hydrogen and iron sulfides by a Langmuir-Hinselwood mechanism. Mixtures of H_2 and D_2 produce $(H,D)H_2S$ with random distributions of H and D. Preliminary studies have been conducted in a 10 cm diameter laboratory scale AFBC unit preparatory to the tests to be conducted on waste fuels.

17918 (ORNL—6025) Fossil Energy Program quarterly progress report for the period ending December 31, 1983. McNeese, L.E. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 121p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84008363.

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This quarterly report covers the progress made during the period October 1 through December 31 for the Oak Ridge National Laboratory research and development projects that are carried out in support of the increased utilization of coal and other fossil fuels as sources of clean energy. These projects are supported by various parts of DOE including Fossil Energy, Basic Energy Sciences, Office of Health and Environmental Research, Office of Environmental Compliance and Overview, the Electric Power Research Institute, and by the Tennessee Valley Authority and the EPA Office of Research and Development through inter-agency agreement with DOE.

17919 Peat as an energy source. Pecoraro, J.M. (U.S. Department of Energy, Boston, MA). pp 371-374 of Geotechnology in Massachusetts. Farquhar, O.C. (ed.). Amherst, MA; Univ. of Massachusetts (1982). (CONF-8003192—).

From Conference on geotechnology in Massachusetts; Boston, MA, USA (20 Mar 1980).

Peat, a potential indigenous fuel source, is beginning to loom larger on the New England energy scene. For centuries, in Europe, its use has been a normal occurrence. As the price of fuel oil escalates, the possibility is developing that New England in general, and Massachusetts in particular, may tap this valuable resource for electrical generation and space heating.

0104 Processing

REFER ALSO TO CITATION(S) 17968, 17980, 17989, 17989, 18022, 18035, 18040, 18046, 18310, 18769

17920 (ACIRL-PR—83-7) ICCP coal hydrogenation residue working group exercise. Hardley, K. (Australian Coal Industry Research Labs. Ltd., North Ryde). Aug 1983. 100p. Australian Coal Industry Research Labs. Ltd., North Ryde.

The report documents the results of an exercise conducted by the Petrographic Hydrogenation Residue Working Group of the International Committee for Coal Petrology (ICCP). Petrographic blocks were prepared of a hydrogenation residue from a high volatile Australian coal and these, with a sample of parent coal and a description of process conditions used to obtain the residue were distributed to members around the world. Members were asked to perform a petrographic analysis; to carry out a quantitative assessment of residues; to supply descriptions of the residues assessed and to study the inorganic components with regard to potential catalytic activity.

17921 (ANL/FE—83-4) Evaluation of radiometric techniques for measuring temperature in coal gasifiers. DiIorio, G.J. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 56p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009124.

Radiometric methods of measuring temperature in coal gasifiers are evaluated. Various methods are investigated in terms of their ability to measure temperature of gas or solids in dilute solids gas/solid volumes of gasifiers such as entrained beds and regions above fluidized beds. Methods investigated include: optical pyrometry, line reversal, Raman scattering, Coherent Anti-Stokes Raman Scattering, laser induced fluorescence and microwave radiometry. Using estimates of the optical properties of BI-GAS Stage I, light propagation through the stage is found to be limited. In general this implies that the optical based methods will be unable to yield temperature information on gasifier interior regions. 76 references, 12 figures, 4 tables.

17922 (ARL-TR—26) Pyrolysis of high volatile bituminous Atlantic coals as a first step in a dual utilization strategy for the production of liquid hydrocarbons and semicoke. Chornet, E. (National Research Council of Canada, Halifax, Nova Scotia). 1981. 51p. (NRCC—19538). National Research Council of Canada, Halifax, Nova Scotia.

Vacuum pyrolysis of three Nova Scotia coal samples indicated that the technique is capable of organic liquids yields between 14 and 18% (m.a.f. coal, basis) and the organic liquids contain an appreciable proportion of high molecular weight compounds (pitch) that can be catalytically hydrogenated under relatively mild conditions.

17923 **(ARL-TR—36) Pyrolysis of coal-lime mixtures. Part 1.** Brothers, J.A.; Crandlemire, A.L. (National Research Council of Canada, Halifax, Nova Scotia). 1981. 24p. (NRCC—20456). National Research Council of Canada, Halifax, Nova Scotia.

An initial program of experimentation on the pyrolysis of coal-lime mixtures has been completed. The goal of a one per cent sulfur char from high sulfur coals (>3 per cent) has been attained. About 40 per cent of the organic sulfur and in excess of 90 per cent of the pyritic sulfur on the coal is retained in the char as calcium sulfide during pyrolysis. A water-hydrogen sulfide leach removes CaS from the char as calcium hydrosulfide; Ca(HS)/SUB/2 is 1000 times more soluble than is CaS. With a coal of low free swelling index (>1.5), sulfur retention in the char and conversion to CaS were satisfactory; with coals of FSI >7, conversion of sulfur to CaS was poor. For high FSI coals, partial oxidation at low temperature (<200 C) or blending with low volatile coal or char are being evaluated as solutions to the low sulfur conversion to CaS. (7 refs.)

17924 **(ARL-TR—38) Elimination of the inhibiting effect of magnesium ion in the oxydesulphurization of coal.** Brothers, J.A. (National Research Council of Canada, Halifax, Nova Scotia). 1982. 15p. (NRCC—20461). National Research Council of Canada, Halifax, Nova Scotia.

Work described was planned to eliminate the magnesium effect by controlling pH during reaction to effect an acidic mileu and establish a pH below which the magnesium compound is not stable. The work was successful. Acidity was controlled by feeding a solution of an alkali (NaHCO/SUB/3) during the run into the pressurized reactor at a rate sufficient to maintain the pH below a value of 3. Industrially a slurry of pulverized limestone would constitute the alkaline feed. Any limestone within the province may now be used in the oxydesulphurization process. (3 refs.)

17925 **(ARL-TR—40) Characteristics and utilization of char - a literature survey.** Stefanski, M.J. (National Research Council of Canada, Halifax, Nova Scotia). 1982. 33p. (NRCC—20468). National Research Council of Canada, Halifax, Nova Scotia.

This compilation of available recent information on the characteristics of char and its possibilities for utilization as a boiler fuel draws conclusions on the need and possible directions of research and development on char. (38 refs.)

17926 **(ARL-TR—41) Pyrolysis of coal-lime mixtures. Part II - The effect of coal free-swelling index.** Brothers, J.A.; Crandlemire, A.L. (National Research Council of Canada, Halifax, Nova Scotia). 1982. 28p. (NRCC—20469). National Research Council of Canada, Halifax, Nova Scotia.

Pyrolysis of coals with a wide range of free-swelling indices and sulfur contents has confirmed that conversion of the sulfur to calcium sulfide on pyrolysis with lime is only effective for low FSI coals. Blending char or a low-swelling coal with a high FSI coal does not sufficiently reduce the free-swelling index with a reasonable blend ratio. Partial oxidation of coal by heating in air at a temperature <200 C readily reduces the FSI. By first reducing the FSI of a high-swelling coal to <1, pyrolysis with lime yields satisfactory CaS formation. With partial oxidation of the coal if required, a low sulfur char product is realized from coals with a range of FSI's, sulfur species and total sulfur content by leaching CaS from the char produced on pyrolyzing coal/lime mixtures. MgO does not absorb H/SUB/2S during coal pyrolysis and therefore is ineffective as a lime substitute. Much of the lime requirement during pyrolysis may be replaced by CaCO/SUB/3 without reducing the degree of calcium sulfide formation. (4 refs.)

17927 **(ARL-TR—42) Pyrolysis of coal-lime mixtures. Part III - Analysis of pyrolysis products: char, condensate and gas.** Brothers, J.A.; Crandlemire, A.L. (National Research Council of Canada, Halifax, Nova Scotia). 1982. 16p. (NRCC—21258). National Research Council of Canada, Halifax, Nova Scotia.

The pyrolysis apparatus has been modified for effective separation and collection of the gas and condensate generated during pryolysis. Pyrolysis runs have been completed for two coals - Prince and Brogan - with and without lime at two heating rates. Organic condensate yields are 11-14% for the Prince coal, 7-10.5% for the Brogan coal. Pyrolytic water and gas yields are quite high, 7-12% and 15-28%, respectively. As with previous coal/lime pyrolysis work, most of the sulfur from the coal is retained in the char and most of this sulfur is in the CaS form, thus permitting a low sulfur char product from medium to high sulfur coals. (5 refs.)

17928 **(ARL-TR—44) The metabolism of thiobacilli and their role in environmental sulphur pollution.** McCready, R. (National Research Council of Canada, Halifax, Nova Scotia). 1983. 82p. (NRCC—22525). National Research Council of Canada, Halifax, Nova Scotia.

For the SABA process (a variation of oil-agglomeration for coal benefication and handling of fine coal particles), it is claimed that the selective adsorption of T. ferroxidans onto the pyrite fraction of coal aids the rejection of pyrite from the agglomerating coal particles. This report describes metabolism of thiobacilli, classification of thiobacilli, chemolithotrophic growth, and heterotrophic growth. The potential pollution problems that may arise if the spherical agglomeration-bacterial adsorption (SABA) process is developed for coal desulfurization prior to combustion are forecast. (214 refs.)

17929 **(ARL-TR—47) Engineering and economic assessment of coal-lime pyrolysis.** Stover, N. (National Research Council of Canada, Halifax, Nova Scotia). 1983. 158p. (NRCC—21259). National Research Council of Canada, Halifax, Nova Scotia.

A preliminary engineering and economic assessment of coal-lime pyrolysis is presented. Pyrolysis systems ranging from bench to commercial scale are reviewed. Two types of atmospheric pressure systems are assessed, those producing char, tar and gas and those producing formed coke. The former have been developed to the PDU scale and the latter to a commercial scale. Two successful approaches have been developed to avoid agglomeration when processing high caking coals such as those in Nova Scotia, preoxidation and reactor design. Preoxidation lowers the yields of tar. Most systems operate at approximately 600 C and have solids residence times in the order of seconds. To successfully carry out coal-lime pyrolysis, an additional process step is required in most cases to increase the temperature to 850 C and the solids residence time to 30 minutes. The Occidental and Toscoal processes, as modified for coal-lime pyrolysis, require a syncrude selling price of 57 dollars/bbl and 61 dollars/bbl (mid 1983 Canadian dollars) respectively to return 15% (on the equity) of a plant built in Cape Breton, Nova Scotia. (53 refs.)

17930 **(BAW/ARC—5259) Improvement of the mechanical reliability of monolithic refractory linings for coal gasification process vessels. Mathematical model for the thermo-mechanical analysis of refractory-lined process vessels.** Malik, S.N. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Sep 1981. Contract AC05-76ET10434. 183p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84007961.

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This report describes the development of the mathematical model, the assumptions inherent in the model, computer implementation of the model, and example analyses of various lining configurations. The computer program can be used to analyze single- and multi-component linings for temperature ranges typical of gasifier vessels. These analyses can be used as a design aid in investigating various parameters for selecting design configurations which reduce the thermo-mechanical degradation of the linings during initial dryout, heatup, and subsequent cool-down of the linings.

17931 (BMFT-FB-T—83-201) Experimental investigation concerning the feasibility of electrostatic precipitators at high pressures and temperatures. Weber, E.; Pape, H.G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 93p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750490.

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For new coal conversion processes it is necessary to develop gas cleaning systems that operate at high pressures and temperatures. The electrostatic precipitator is a high efficiency separator for this application. The first objective of this research project was to study the principal applicability of the electrostatic precipitator at temperatures up to 1000°C and pressures up to 40 bar. Secondary the effectivity of the precipitator had to be measured for different states of gas and various dimensions of the separator. It has been demonstrated that an operation of electrostatic precipitators is possible under extreme gas conditions allowing high degrees of separation. The results of the laboratory scale experiments are to be confirmed under industrial conditions at a modified pilot plant. By that data for the dimensioning of large scale precipitators can be obtained.

17932 (BNL—34087) Enhanced ethylene production via flash methanolysis of coal. Sundaram, M.S.; Steinberg, M.; Fallon, P. (Brookhaven National Lab., Upton, NY (USA)). Dec 1983. Contract AC02-76CH00016. 18p. (CONF-840415—16). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008175.

From 187. national meeting of the American Chemical Society; St. Louis, MO, USA (8 Apr 1984).

According to a recent report, an estimated 31 billion pounds of ethylene was produced in the US alone. Ethylene is an important raw material in the vast plastic and polymer markets. An upward trend in the demand for ethylene has been predicted for the future years. Currently, ethylene is produced mainly through thermal and catalytic hydrocracking of ethane and other hydrocarbons. Although a large amount of work has been performed on the production of gaseous and liquid fuels from coal, much less attention has been focused on the production of ehtylene using coal as the raw material. In an on-going pyrolysis research project at the Brookhaven National Laboratory, methods for increasing the yield of ethylene through flash methanolysis of coal are being investigated. Flash methanolysis is defined as pyrolysis of coal under pressure in an atmosphere of methane. This study attempts to identify the influence of important process variables such as reaction temperature, gas pressure, solids residence time, gas/solids ratio etc on the production of ethylene and other pyrolysis products. We have shown that there are definite advantages in the use of methane as an atmosphere in the flash pyrolysis of coal. At temperatures higher than 800°C, 2 to 5 times greater yields of ethylene are obtainable in methane atmosphere compared to flash pyrolysis in an inert helium atmosphere. An enhancement in the yield of ethylene and BTX are important raw materials in the vast polymer and plastic markets, flash methanolysis of coal has potential process applications. 5 references, 4 figures, 6 tables.

17933 (CONF-821145—7) Performance of alloys in liquefaction pilot plants. Keiser, J.R.; Judkins, R.R.; Baylor, V.B.; Olsen, A.R.; DeVan, J.H. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007610.

From 7. materials for coal conversion and utilization conference; Gaithersburg, MD, USA (16 Nov 1982).

Laboratory and pilot plant investigations of corrosion and stress corrosion cracking in coal liquefaction systems continue to demonstrate the need for caution in selecting materials for use in these systems. The importance of an adequate design-materials interface is also evident from these studies. 8 references.

17934 (CONF-840405—8) High-temperature corrosion in coal gasifiction systems. Natesan, K. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84005412.

From NACE corrosion '84 international forum and exhibition; New Orleans, LA, USA (1 Apr 1984).

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Over the last 10 years, extensive research has been performed to evaluate the compatibility of engineering materials and model alloys in multicomponent gas environments that are relevant to various coal gasification schemes. This paper examines the available information to give insight into the development of protective scales on alloy surfaces and causes of scale breakdown. In addition, the available long-term kinetic data on sound-metal loss are examined to evaluate the effects of alloy and gas chemistry on corrosion of materials in coal gasification atmospheres. 11 references, 15 figures.

17935 (DOE/ET/10069—T82) EDS coal liquefaction process development. Phase V. EDS Consolidation Program: flushing and blowdown system design. (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Jan 1984. Contract FC05-77ET10069. 50p. (FE—2893-127). NTIS (US Sales Only), PC A03/MF A01; GPO Dep. Order Number DE84007767.

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The flushing and blowdown system of an EDS plant provides the means of removing viscous coal products and slurry streams from plant vessels and lines. In addition, it provides the flushing oil needed during normal operations for purging instruments in slurry service, for flushing slurry pump and slurry agitator seals, and for flushing slurry safety valve inlet lines. It contains a blowdown system for collecting material from washing operations, including the transport of the collected material to slop tankage. The rerun options for depleting the inventory of collected slop are a related aspect of the flushing and blowdown system design although specific equipment for handling slop is not part of the flushing and blowdown system facilities. This report documents the results of a study which evaluates the flushing and blowdown requirements for a commercial-scale EDS plant. The work was conducted as part of the EDS Consolidation Program. The design recommendations represent a consolidation of learnings accrued during previous phases of the EDS Project including results obtained from ECLP operations, from the ECLP Test Program, and from past EDS Study Design preparations. 1 reference, 4 figures, 2 tables.

17936 (DOE/ET/10069—T83) EDS coal liquefaction process development: Phase V. Final technical progress report, Volume I. (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Feb 1984. Contract FC05-77ET10069. 204p. (FE—2893-121). NTIS (US Sales Only), PC A10/MF A01; 1; GPO Dep. Order Number DE84007771.

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All objectives in the EDS Cooperative Agreement for Phases III-B through V have been achieved for the RCLU pilot plants. EDS operations have been successfully demonstrated in both the once-through and bottoms recycle modes for coals of rank ranging from bituminous to lignitic. An extensive data base detailing the effects of process variable changes on yields, conversions and product qualities for each coal has been established. Continuous bottoms recycle operations demonstrated increased overall conversion and improved product slate flexibility over once-through operations. The hydrodynamics of the liquefaction reactor in RCLU were characterized through tests using radioactive tracers in the gas and slurry phases. RCLU was shown to have longer liquid residence times than ECLP. Support work during ECLP operations contributed to resolving differences between ECLP conversions and product yields and those of the small pilot plants. Solvent hydrogenation studies during Phases IIIB-V of the EDS program focused on long term activity maintenance of the Ni-MO-10 catalyst. Process variable studies for solvents from various coals (bituminous, subbituminous, and lignitic), catalyst screening evaluations, and support of ECLP solvent hydrogenation operations. Product quality studies indicate that highly cyclic EDS naphthas represent unique and outstanding catalytic reforming feedstocks. High volumes of high octane motor gasoline blendstock are produced while liberating a considerable quantity of high purity hydrogen.

17937 **(DOE/ET/10069—T84) EDS coal liquefaction process development: Phase V. Monthly technical progress report, December 1-31, 1983.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Jan 1984. Contract FC05-77ET10069. 12p. (FE—2893-126). NTIS (US Sales Only), PC A02/MF A01; 1; GPO Dep. Order Number DE84007880.

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Highlights are summarized as follows: (1) A recently developed semi-empirical correlation predicts that the maximum difference in solids concentration between passes of a commercial-scale slurry distribution manifold will be only 3.2 percent. (2) Gasification tests have been completed on EDS recycle vacuum bottoms produced from Texas lignite in the Texaco Gasification Process operated by Ruhrkohle/Ruhrchemie in Oberhausen-Holten, West Germany. All test objectives were met. (3) EDS bottoms-fired hybrid and steam boiler technology has been developed to commercial readiness for an EDS plant application.

17938 **(DOE/ET/10069—T85) EDS Coal Liquefaction Process Development. Phase V. Laboratory evaluation of the characteristics of EDS Illinois bottoms.** Lao, T.C.; Levasseur, A.A. (Combustion Engineering, Inc., Windsor, CT (USA). Kreisinger Development Lab.). Feb 1984. Contract FC05-77ET10069. 207p. (FE—2893-112). NTIS (US Sales Only), PC A10/MF A01; 1; GPO Dep. Order Number DE84008043.

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This interim report documents work carried out by Combustion Engineering, Inc. under a contract to Exxon Research and Engineering Company to develop a conceptual Hybrid Boiler design fueled by the vacuum distillation residue (vacuum bottoms) derived from Illinois No. 6 coal in the EDS Coal Liquefaction Process. This report was prepared by Combustion Engineering, Inc., and is the first of two reports on the predevelopment phase of the Hybrid Boiler program. This report covers the results of a laboratory investigation to assess the fuel and ash properties of EDS vacuum bottoms. The results of the laboratory testing reported here were used in conjunction with Combustion Engineering's design experience to predict fuel performance and to develop appropriate boiler design parameters. These boiler design parameters were used to prepare the engineering design study reported in EDS Interim Report FE-2893-113, the second of the two reports on the predevelopment phase of the Hybrid Boiler Program. 46 figures, 29 tables.

17939 **(DOE/ET/10532—T16) Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, October-December 1983.** Sullivan, R.F. (Chevron Research Co., Richmond, CA (USA)). Feb 1984. Contract AC22-76ET10532. 64p. (FE—2315-99). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007586.

A second-stage hydrocracker feed was prepared by blending hydrotreated 350°F$^+$ Integrated Two-Stage Liquefaction (ITSL) product from Pilot Plant Run 86-75. A second-stage hydrocracking run has been in progress for about 800 hours with this feed and Chevron's commercial ICR 202 catalyst. This report gives the inspections of the second-stage hydrocracker feed; additional yield data and product properties from hydrotreating tests; and inspections of heavy ITSL distillate before and after filtration and distillation. It also includes, as an appendix, a recent paper summarizing results of the ITSL study to date. 5 references, 11 figures, 9 tables.

17940 **(DOE/ET/10735—T2) Two-stage coal liquefaction process: development of first-stage catalyst. Final report, October 1978-June 1980.** Kang, C.C.; Bajars, L.; Ozawa, S.; Bekker, A. (Catalysis Research Corp., Palisades Park, NJ (USA)). Sep 1981. Contract AC22-78ET10735. 70p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84006446.

The objective of this project is to evaluate the advantages of a two-stage coal liquefaction process using catalysts with optimum pore sizes in each stage. A catalyst with optimized pore diameters (considered to be in the range of greater than 1000 Angstrom) could be used in the first-stage to hydroconvert the large coal molecules to residuum containing mainly asphaltenes (toluene-soluble) which are essentially metal-free. A catalyst with pore diameter predominantly in the range smaller than 1000 Angstrom and greater than 100 Angstrom could be used in the second-stage to convert the asphaltenes to distillates. An eighteen-month research program was conducted to develop a macropore catalyst for the first-stage. A batch screening autoclave unit was used to select a macropore catalyst with optimum pore size distribution. Catalysts with median pore diameter ranging from 2350 to 32,000 Angstrom and surface area from 6.9 to 2.5 m^2/g and containing 1.5% (Mo+Ni or Mo+Co) were evaluated. Macropore catalysts with median pore diameters of 2350, 4000, 8400 and 8800 Angstrom yielded significantly lower unconverted coal plus coke than the reference (or standard) H-Coal catalyst (American Cyanamid HDS 1442A). Evaluation at two reaction temperatures, 830°F and 850°F, demonstrated that these four macropore catalysts were at least as resistant to coking as HDS 1442A. 5 references, 15 figures, 10 tables.

17941 **(DOE/FE/60181—51) Determination of emission characteristics from the UNDERC cooling tower.** Mann, M.D.; Galegher, S.J. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 16 Feb 1984. Contract FC21-83FE60181. 5p. (CONF-840261—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007409.

From 24. annual regional symposium of the Twin City Section of the AIChE; St. Paul, MN, USA (16 Feb 1984).

The Great Plains Gasification Associates (GPGA) plant at Beulah, North Dakota, and many other synfuels plants in the future, will be producing thousands of gallons of wastewater per day. There is a need for development of environmental data concerning effluents from fixed-bed coal gasification. The University of North Dakota Energy Research Center (UNDERC) is addressing this need as one of the principle goals of its wastewater treatment program. UNDERC has various types of wastewater treatment and reuse unit operations, designed to yield scaleable data, which are currently being operated on wastewater from the UNDERC slagging fixed-bed gasifier. A part of this equipment is a forced-draft cooling tower which utilizes this wastewater as makeup. Phase I cooling tower testing at UNDERC was designed to use as feed minimally treated wastewater (solvent extracted for organics removal and steam stripping for ammonia and acid gas removal) to simulate the proposed GPGA water treatment plan. A crucial part of this study was the determination of the atmospheric effects resulting from the use of the stripped gas liquor (SGL) as feed to the cooling tower. Several types of sampling equipment including a multicyclone, cooled impingers, and an XAD resin trap, were used for the collection and retention of components present in the tower evaporate. A comparative study of several drift measurement techniques was also performed using chemical and material balances around the system. Results indicated that a significant portion of phenol and ammonia in the makeup water (91 and 81 percent, respectively) were stripped into the atmosphere. Twenty-one percent of the methanol was also stripped.

17942 **(DOE/FE/60181—56) Automated capillary gas chromatographic analysis of low-rank coal liquefaction products.** Raynie, D.E.; Farnum, S.A.; Potts, Y.R. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 4p. (CONF-8404108—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006382.

From Chromatography spring symposium; Minneapolis, MN, USA (16 Apr 1984).

Capillary g.c. has been used at the University of North Dakota Energy Research Center for the automated identification and quantitation of 87 different compounds in a single coal-liquefaction product. Samples of light oil and recycle slurry distillate oil from the bottoms recycle liquefaction process are initially separated into twelve fractions by silica gel column chromatography. The twelve fractions are combined into five major groups containing alkanes, polycyclic aromatic hydrocarbons, and phenols. Hydrocarbon fractions are initially characterized by 200 MHz ^{1}H NMR. Capillary g.c. is used for final analysis and quantitation. A discussion of the selection of an internal standard, calibration techniques, temperature program selection, and calculations is included. The system chosen is capable of accommodating an autosampler, multilevel temperature programming, and cryogenic cooling. Identifica-

tion of ample components is done by comparing retention times and confirming the identification with gas chromatography/mass spectroscopy. Up to 30 components have been quantitated in a fraction.

17943 (DOE/FE/60181—59) Identification of mono methyl-dibenzothiophenes in coal liquefaction products. Kongshaug, P.A.; Miller, D.J. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Feb 1984. Contract FC21-83FE60181. 4p. (CONF-8404105—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006377.

From North Dakota Academy of Science conference; Fargo, ND, USA (26 Apr 1984).

Previous work has involved investigations into the effects of H_2S on the liquefaction of low-rank coal. Addition of H_2S to the process, increases the yield and improves the quality of distillable oils, but may be incorporated into the product oil. We are therefore interested in the detection and identification of sulfur compounds in liquefaction products; especially as this pertains to sulfur incorporation. The liquefaction process is typically conducted in the presence of a hydrogen donor solvent. The samples analyzed in this work were portions of the products of two runs which employed two distinctly different startup solvents. Authentic samples of the four isomeric methyldibenzothiophenes were synthesized according to published procedures and characterized by correlation of ^1H NMR chemical shifts. ^{13}C NMR and mass spectroscopy were used for further characterization. Dibenzothiophene and the methyldibenzothiophenes in the samples from Runs 101 and 103 were initially identified by GC/MS. Unfortunately, the individual isomers could not be distinguished, since each exhibited the same fragmentation pattern. The isomers were subsequently identified by matching their GC retention times with those of the authentic samples. Analysis of the PDU startup solvent (Run 103) showed that these sulfur compounds were present; therefore we are unable to conclude whether any sulfur incorporation had occurred. We can conclude, however, that sulfur incorporation occurred in Run 101 since analysis of startup solvent A04 indicated that sulfur compounds were not present initially. 6 references.

17944 (DOE/METC/SP—199) Gasification technology data base. (USDOE Morgantown Energy Technology Center, WV; EG and G/Washington Analytical Services Center, Inc., Morgantown, WV (USA)). Dec 1983. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84003055.

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This report documents the background, philosophy, functions served, evolution process, specific results, and current status of the gasification technology data base activity at the Morgantown Energy Technology Center (METC). METC has lead reponsibility for coal gasification within the US Department of Energy. This responsibility includes the identification, planning, and execution of coal gasification activities which offer potentially high pay-offs for the National energy future. A well-organized and quantified descriptions of the state of the art (SOA) is a valuable reference tool in carrying out this obligation. The Gasification Technology Data Base (GTDB) will serve as a reference tool and mechanism by which lessons learned during the course of research and development can be captured. The GTDB activity was a significant extension of previous data base activities at METC. It was initiated by the realization that the Alternative Fuels legislation (Public Law 96-126) had created a unique window of technical opportunity; specifically, approximately 20 unusually credible design studies for coal gasification based commercial plants were being performed, and there was a likelihood that some of them would evolve into actual plants. Consequently, a significant fraction of corporate wisdom was being documented in coal gasification studies that could serve as an extraordinarily good input source for the GTDB. The basic objective of the GTDB was to intergrate the results of the various studies and the related METC work to define the SOA. Simultaneously, it was expected to provide a highly workable reference that would facilitate analyses to perform cross comparisons, to quantify the potential value of new approaches, to identify technology gaps, et cetera. In short, with proper integration, the value of the whole could readily exceed the sum of its parts. 5 figures, 8 tables.

17945 (DOE/PC/30075—T1) Crossed reaction networks in the catalytic hydrodenitrogenation of synthetic liquid fuels. Final report. Satterfield, C.N. (Massachusetts Inst. of Tech., Cambridge (USA)). 10 Mar 1984. Contract AC22-80PC30075. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007714.

Several of our findings are particularly noteworthy: (1) we have shown that the method of presulfiding of a commercial $NiMo/Al_2O_3$ catalyst can have a significant effect on its activity for hydrodenitrogenation (HDN) of quinoline. Of three methods studied, the most intense resulted in the most active catalyst, whereas in hydrodesulfurization an intermediate degree of presulfiding seems to be best; (2) in addition to the above, addition of H_2S to the reaction mixture increases the HDN rate and removal of H_2S decreases it, in a reversible manner; (3) small concentrations of water vapor also increase HDN, especially if H_2S is also present. An oxygenated compound such as a phenol or furan may decrease the rate of HDN, if it is relatively unreactive, by competitive adsorption. However, water, formed by HDO reactions, will increase HDN; (4) the kinetic behavior of quinoline HDN is remarkably the same in liquid-phase reaction as in vapor-phase reaction. The accelerating effects of H_2S work similarly in either phase; and (5) addition of NH_3 markedly reduces the rate of hydrogenation reactions. Although it also reduces HDN rates, this is an interesting lead to a means of reducing overall hydrogen consumption in hydrotreating reactions.

17946 (DOE/PC/40009—T7) Advanced coal liquefaction catalyst development. Quarterly progress report No. 8. Mahoney, J.A.; Schwartz, M.M.; Wittrig, T.S. (Amoco Research Center, Naperville, IL (USA)). Dec 1983. Contract AC22-81PC40009. 29p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007330.

Coal liquefaction results with and without Amocat catalysts at various conditions (especially with respect to variations of hydrogen pressure and organic solvent) are reported. (LTN)

17947 (DOE/PC/40799—T8) Heteroatam speciation in coal liquefaction via FTIR coupled with liquid chromatography. Quarterly progress report, April 1, 1983-June 30, 1983. Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Nov 1983. Contract FG22-81PC40799. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84002134.

By employing short microbore columns (50 cm) with a 0.2 mm pathlength cell and a wide range detectorl LC-FTIR is capable of detecting and identifying the injection of sub-microgram quantities of a variety of compound classes. By increasing the pathlength of the flow cell and decreasing its volume to $\sim$ 1 μL while employing the more sensitive restricted range detector, good quality spectra should be obtained from several hundred nanograms of injected compounds. Derivatization can aid detectability and improve chromatographic performance for polar compounds such as amines and phenols. This technique should help HPLC-FTIR find more general utility in the analytical laboratory. Faster acquisition rates can be obtained by going to lower spectral resolution (i.e. 8 cm^{-1}) or by increasing the mirror velocity (up to $\sim$ 5 times faster) or both while still maintaining comparable or improved S/N. Alternatively, this could provide finer chromatographic detection. The latter would cause a large consumption of disk space which for long chromatographic runs is limited with our current system. Additional disk hardware can alleviate this problem. 25 references, 5 tables, 2 figures.

17948 (DOE/PC/40810—8) Synthesis of oligomeric models of coal derived materials for use with GPC calibration. Quarterly report, October-December 1983. Baltisberger, R.J.; Jones, M.B. (North Dakota Univ., Grand Forks (USA)). Feb 1984. Contract FG22-81PC40810. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007393.

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The purpose of this study was to develop a set of Gel Permeation Chromatography (GPC) calibration standards for asphal-

tene and preasphaltene analysis. A series of oligo(aryl ether) and oligo(arylmethylenes) from 170 to 580 g/mole were prepared via modified Ullmann-type reactions (ethers) and condensation of an aryl lithium derivative with an aryl carboxaldehyde, followed by reduction of the resulting carbonol (methylenes). These compounds were examined as molecular weight calibration standards for GPC analysis. A nearly linear plot was found to exist between the logarithm of molecular weight times mol fraction hydrogen versus retention volume with THF as the solvent. Further this plot was coincident with commercial polystyrene standards (600 to 2000 g/mol) and with the majority of our lignite derived asphaltenes and preasphaltenes. Work in our laboratory suggests that universal calibration plots for GPC analysis of lignite-derived preasphaltene and asphaltene liquefaction products are possible for determining number and weighted average molecular weight values. Universal calibration plots based on the logarithm of the hydrodynamic volume, number average molecular weight times hydrogen content, result in a smooth curve coincident with polystyrene standards, model compounds, and lignite derived asphaltenes/preasphaltenes. The data which supports the above hypothesis is presently limited and has only been measured for lignite-derived materials. 18 references, 6 figures.

17949 **(DOE/PC/50041—30) Wilsonville Advanced Coal Liquefaction Research and Development Facility, Wilsonville, Alabama. Topical report No. 14. Catalyst activity trends in two-stage coal liquefaction.** (Catalytic, Inc., Wilsonville, AL (USA)). Feb 1984. Contract AC22-82PC50041. 103p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84008341.

The Two Stage Coal Liquefaction process became operational at Wilsonville in May 1981, with the inclusion of an H-OIL ebullated-bed catalytic reactor. The two stage process was initially operated in a nonintegrated mode and has recently been reconfigurated to fully integrate the thermal and the catalytic stages. This report focuses on catalyst activity trends observed in both modes of operation. A literature review of relevant catalyst screening studies in bench-scale and PDU units is presented. Existing kinetic and deactivation models were used to analyze process data over an extensive data base. Based on the analysis, three separate, application studies have been conducted. The first study seeks to elucidate the dependence of catalyst deactivation rate on type of coal feedstock used. A second study focuses on the significance of catalyst type and integration mode on SRC hydrotreatment. The third study presents characteristic deactivation trends observed in integrated operation with different first-stage thermal severities. In-depth analytical work was conducted at different research laboratories on aged catalyst samples from Run 242. Model hydrogenation and denitrogenation activity trends are compared with process activity trends and with changes observed in catalyst porosimetric properties. The accumulation of metals and coke deposits with increasing catalyst age, as well as their distribution across a pellet cross-section, are discussed. The effect of catalyst age and reactor temperature on the chemical composition of flashed bottoms product is addressed. Results from regenerating spent catalysts are also presented. 35 references, 31 figures, 18 tables.

17950 **(DOE/PC/50041—31) Wilsonville Advanced Coal Liquefaction Research and Development Facility, Wilsonville, Alabama. Technical progress report, Run 243 with Illinois 6 coal.** (Catalytic, Inc., Wilsonville, AL (USA)). Feb 1984. Contract AC22-82PC50041. 175p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84007882.

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This report presents the operating results for Run 243 at the Advanced Coal Liquefaction R and D Facility in Wilsonville, Alabama. This run was made in an Integrated Two-Stage Liquefaction (ITSL) mode using Illinois 6 coal from the Burning Star mine. The primary objective was to demonstrate the effect of a dissolver on the ITSL product slate, especially on the net C_1-C_6 gas production and hydrogen consumption. Run 243 began on 3 February 1983 and continued through 28 June 1983. During this period, 349.8 tons of coal was fed in 2947 hours of operation. Thirteen special product workup material balances were defined, and the results are presented herein. 29 figures, 19 tables.

17951 **(DOE/PC/60048—1) Advanced direct coal liquefaction. Quarterly technical progress report No. 1, September-November 1983.** Paranjape, A.S. (Kerr-McGee Corp., Oklahoma City, OK (USA). Project Engineering Dept.). 7 Feb 1984. Contract AC22-83PC60048. 114p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84006704.

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Wyoming subbituminous coal was liquefied using three different two-stage process configurations in bench-scale tests. These process configurations differed in the type of fractionated deashing resid being recycled to the individual stages. The objective of these runs was to determine whether, by recycle of specific resid streams to the thermal stage, the second stage catalyst life could be improved without detrimentally affecting distillate yield or hydrogen consumption. The results indicate that the two-stage process configuration consisting of hydrotreating the Light Deashed Resid and direct recycle of heavy Deashed Resid to the thermal stage produced the best results. This process configuration resulted in a distillate yield of 54 wt % (MAF coal basis) and overall coal conversion in the 93 to 95% range, as measured by pyridine-soluble analytical test while operating in a total distillate mode. These results are very encouraging from the lower rank Wyoming subbituminous coal. Among the three two-stage process configurations tested, the particular process configuration of hydrotreating Light Deashed Resid resulted in the least amount of catalyst deactivation. As a part of this research effort, a test procedure for quick evaluation of various resids and catalysts in terms of coke precursors was also developed. This procedure utilizing as-produced oxide-form extrudates of catalyst is able to simulate closely in a batch reactor test the performance of a presulfided and extrudate form of catalyst in a continuous reactor. The CSD unit, being able to not only deash but also fractionate the resid, greatly increased the flexibility of options for coal liquefaction. New process concepts evolved incorporating reside fractionation and selective resid recycle in coal liquefaction. 17 figures, 28 tables.

17952 **(DOE/PC/60054—T1) Coal liquefaction - investigation of reactor performance, role of catalysts and PCT properties. Quarterly progress report, October 1, 1983-December 31, 1983.** Brainard, A.J.; Shah, Y.T.; Tierney, J.W.; Wender, I.; Albal, R.; Bhattacharjee, S.; Kulkarni, A.; Seshadri, K.S. (Pittsburgh Univ., PA (USA). Dept. of Chemical Engineering). 1984. Contract FG22-83PC60054. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007394.

The objective of this work is to investigate areas of science and technology that have been defined as being of prime interest to coal processing technology development. These areas include properties of coal liquids and slurries, reactor design and performance in relation to reaction mechanisms. The work comprises investigations of the following high priority areas. Reaction kinetics and reactor performance in direct coal liquefaction; role of catalysts in indirect liquefaction and direct coal liquefaction; and physical, chemical and thermodynamic properties of coal liquefaction products. Work during the last quarter has largely been devoted to seaching the Liquefaction Technology Data Base and other relevant sources for literature citations. A detailed description of work in each of the three tasks is given. Six abstracts which were prepared in connection with the PCT properties of coal liquids are attached as an Appendix.

17953 **(DOE/PC/61256—T1) Coal conversion processes. Quarterly report, September 13-December 12, 1983.** Cobb, J.T.; Biloen, P.; Holder, G.D.; Klinzing, G.E.; Tierney, J.W. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Jan 1984. Contract FG22-83PC61256. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007529.

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Experimental work has begun on four separate projects related to coal conversion processes. An experimental adiabatic flow reactor has been modified to study the direct digital control of exothermic multiphase reactions. The computer program controlling the reactor has been changed to reflect the equipment modifications. Two Fischer-Tropsch catalysts have been tested preliminar-

ily. A chromatographic apparatus has been refitted to study the absorption of SO_2, NO and NO_2 by various liquid chemicals. Amines (including triethylene tetramine), N-cyclohexyl-2-pyrrolidone, liquid membranes and stabilized liquid membranes will be tested. Tests have begun in another experimental fixed-bed flow reactor system, which uses an on-line mass spectrometer and various isotopes of carbon and hydrogen to study the mechanism of synthesis gas conversion on composite catalysts. Initial tests of this method show that the use of ^{13}C alone is insufficient. The use of both ^{13}C and D (deuterium) will be tested next. Tests in an experimental apparatus for supercritical extraction of coal with water-piperidine mixtures have been made. Results obtained with Illinois No. 6 and Bruceton bituminous coals have been compared with earlier results using Powhattan No. 5 coal. Effects of variations in the preasphaltene content of the coal and the hydrogen donor characteristic of the solvent have been found.

17954 **(ECN—83-166) A thermochemical study of the reactive intermediate in the alkali-catalysed carbon gasification. 1. X-ray diffraction results on the alkali-carbon interaction.** Tromp, P.J.J.; Cordfunke, E.H.P. (Stichting Energieonderzoek Centrum Nederland, Petten). Oct 1983. 16p. Stichting Energieonderzoek Centrum Nederland (ECN), Petten.

Interaction compounds of metallic potassium with graphite or activated carbon have been prepared and characterized by means of X-ray diffraction. The thermal stability of these compounds has been studied by quenching experiments and high temperature X-ray diffraction (HTX). It is shown that potassium-carbon intercalation compounds are thermodynamically not stable at temperatures at which the alkali-catalyzed carbon gasification proceeds (950-1150 K). On the other hand, HTX patterns exhibit a considerable interaction between K/SUB/2CO/SUB/3 and the activated carbon at the gasification temperatures. Interaction with Na/SUB/2CO/SUB/3 also takes place, but at much higher temperatures than with K/SUB/2CO/SUB/3. Increasing pretreatment temperatures of the activated carbon resulted in a decrease of the alkali-carbon interaction, whereas with graphite no interaction at all takes place. This indicates that surface groups on the carbon are the reactive sites for this interaction. (Available from ECN, PO Box 1, NL-1755 ZG Petten, The Netherlands).

17955 **(EQL—19) Water consumption rates of synthetic fuel industries: a cross-reference guide to the open literature.** Isaacson, M.S. (California Inst. of Tech., Pasadena (USA). Environmental Quality Lab.). Dec 1981. 198p. NTIS, PC A09/MF A01; GPO Dep. Order Number DE84006914.

There is a great deal of controversy over how much water synthetic fuel industries will consume. Although this controversy can not be definitely settled until such industries are actually in operation, this report attempts to put it into perspective by summarizing, in an orderly fashion, the water consumption values for synthetic fuel industries found in a major portion of the open literature. Often the values started in the literature are neither clearly delineated nor substantiated. In many cases they have been borrowed - and reborrowed - from earlier reports. A number of times this has led to seemingly independent reports having actually obtained their values, indirectly, from the same original source (as occurred in a recent, major National Science Foundation study). In addition, the values are often stated in different units in different reports, making comparisons awkward. This survey includes unit-water- requirement values for coal gasification (producing substitute natural gas - SNG), coal liquefaction, and oil-shale processing from over 150 references found in the open literature. The primary conclusion drawn from this survey is that only a handful of key reports have been responsible for most of the water-use values appearing in the open literature. Based on the members of this subgroup which appear to be most reliable, the following rule of thumb is recommended: for water consumption by future synthetic fuel industries a best guess estimate is 80 $m^3/10^{12}J$ (of product) and a conservative (high) best guess estimate is 110 $m^3/10^{12}J$. 315 references, 3 figures, 11 tables.

17956 **(EUR—8126-FR) Horizontal shrinkage and wall pressure in coke ovens (Report on ECSC contract 7220-EB/311).** (Commission of the European Communities, Luxembourg). 1983. 42p. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The effects of grain size, coking speed and coal oxidation on horizontal shrinkage were measured at the end of the coking process. The effect of coke cracking and charge pressure on horizontal shrinkage was shown, and the interaction between shrinkage and pressure was investigated. (In French)

17957 **(EUR—8384-FR) Study of the optimum conditions for the manufacture of coke in conventional coke ovens (Report on ECSC contract 7220-EB/315).** (Commission of the European Communities, Luxembourg). 1983. 26p. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

An investigation was carried out into optimizing coke production by influencing the different parameters involved, namely formulation of blends, charging techniques and coking methods. Tests showed that the rate of addition of coal to a coking blend depended largely on the characteristics of the coking coal selected. The maximum rate of incorporation is always dictated by the cohesion of the coke. (In French)

17958 **(EUR—8387-EN) Continuous analysis of the waste gases of a coke battery in order to reduce the heat consumption per tonne of coke (Report on ECSC contract 7220-EB/602).** (Commission of the European Communities, Luxembourg). 1983. 44p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The continuous analysis of waste gases of a coke battery can lead to a lowering of the energy consumption. This can be achieved by: realising a more constant oxygen content in the waste gases, and controlling the heating system in every individual heating wall. Failures can also be detected at an early stage.

17959 **(EUR—8389-FR) Development of systematic monitoring of the heat supplied to coke oven batteries and of the carbonization of coal (Report on ECSC contract 7220-EB/312).** (Commission of the European Communities, Luxembourg). 1983. 31p. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

Methods of monitoring coke oven temperatures were established and new fixed sensors for providing continuous readings were developed. The research covered: determination of battery temperature by using thermocouples; monitoring the longitudinal and vertical readings of oven temperatures by means of an infrared pyrometer; monitoring of combustion in heating flues using 3 continuous oxygen, carbon monoxide and carbon dioxide analysers; and determining when carbonization of coal is complete, by measuring the temperature or determining the composition of distillation gases at the end of coking. (In French)

17960 **(NP—4770201) Ethoxylation as aid to separate brown coal low-temperature carbonization tars and high-temperature tars.** Vogts, A. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 23 Feb 1979. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770201.

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This work describes the significance of brown coal tar as raw material source for chemical industry. 6% tar is yielded in low-temperature carbonization of brown coal as side product. This tar as opposed to bituminous coal tar does not occur as raw material in the Federal Republic of Germany. Numerous derivates are produced from brown coal low carbonization tar in central Germany. The paraffin, olefin and mining wax production is the main feature. Tar from brown coal of the Rhine is rich in creosotes, so classical physical separation processes cannot be applied here. One can react the creosotes with ethylene oxide and then separate off by extraction with water or decanting. Both methods are described and the ethoxylation conditions are shown. The paraffins and olefins obtained can be processed in a similar way to petroleum chemistry. The creosote polyglycol ethers produced in different molar ratios as intermediate and end products of coal chemistry are of increasing interest. Examples are given. Although one can hardly expect an increase of the occurrence of brown coal tar in the near future,

its significance in view of the rediscovery of the possibilities of coal chemistry is increasing due the lack of petroleum.

17961 **(ORNL/TM—8975) Program plan for development of hot dirty gas valves for coal gasification systems.** Kahl, W.K. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 68p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009120.

This study was conducted to provide supporting data for a proposed Department of Energy program for the development of components for service in gasification systems. This report addresses hot, dirty gas valve applications and was scoped to consider a broad range of gasification systems, including the generic models for entrained-flow, moving-bed, and fluidized-bed gasifiers. The major gasification process areas that can potentially utilize hot, dirty gas valves are coal feeding, ash quench and removal, and gas cleanup. The significant applications associated with these areas include block valves and pressure relief/safety valves. The conditions and requirements for these applications vary over a wide range of values with temperatures up to 982°C and pressures up to 5.17 MPa. The presence of sticky and dry particulates also contributes to the overall hostile environment. A state-of-the-art industrial capabilities survey revealed that there was little documented experience with hot, dirty gas valves in gasification systems. Most valve manufacturers do not offer off-the-shelf products that can readily meet the more severe operation requirements. Based on operating experience in other fields involving hot, dirty gas handling, there is substantial evidence that the high temperatures and particle loadings of coal gasification present genuine technical challenges in these areas. A research and development program was developed for the demonstration of the applicability of commercially available valves and for the advancement of valve technology for hot, dirty gas situations. 60 references, 1 figure, 4 tables.

17962 **(PB—84-142611) Model study of combined forced and free convection in underground coal conversion of thin coal seams. Annual report, May 1982-June 1983.** Riggs, J.B. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). Jun 1983. 30p. NTIS, PC A03/MF A01.

An experimental test model, which is dynamically similar to an actual UCC (Under ground Coal Conversion) system, has been used to determine fluid flow patterns and local heat transfer that occur in the UCC burn cavity. This study should provide insight into the little understood mechanisms (i.e., heat transfer and oxygen transport to the cavity walls) which control maximum cavity width, and therefore resource recovery during UCC. The experimental system is operational and producing physically realistic results. The qualitative results of this study have shown the dominant effect of free convection on the flow pattern of the system.

17963 **(PNL—4962) Chemical and biological stability of solvent refined coal liquids.** Wright, C.W.; Weimer, W.C. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1984. Contract AC06-76RL01830. 132p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84007551.

Stability studies performed on seventeen SRC samples in boiling point from ambient to 850°F showed that the major chemical composition of the materials as monitored by high resolution gas chromatography did not change under the storage conditions of the repository, which were 4°C, in inert containers, under a nitrogen atmosphere, in the dark. Samples were monitored after two years of storage. It was also found from microbial mutagenicity studies that after four years in the repository there was no significant change in the biological activity of any of the SRC materials. Samples stored under various parameters of air versus nitrogen atmosphere and ambient light versus darkness at room temperature and -20°C for one year showed there was no significant differences in the chemical composition of any of the samples. There was evidence, however, that trace components such as amino-PAH degraded at room temperature, in the light, under an air atmosphere since the microbial mutagenicity of samples stored under these conditions for one year decreased significantly. Both the chemical composition and mutagenicity of FOB samples changed when stored diluted in methylene chloride, in the light, under an air atmosphere at room temperature. After one year of storage under these conditions, the microbial mutagenicity was eliminated. Storage of SRC-II FOB at increased temperatures of 60°C and 100°C showed significant changes in chemical composition due to volatility effects. The microbial mutagenicity of the FOB samples was completely eliminated after storage at 60°C for 32 weeks and 100°C for 26 weeks. It appears that the amino-PAH and phenolic materials are the most susceptible components to degradation in the complex SRC materials. 23 references, 29 figures, 50 tables.

17964 **Preparation of low-sulfur fuel gas for gasification of Battelle treated coal.** Conkle, H.N. (Battelle Columbus Lab., OH); Feldmann, H.F.; Hahn, O.J. *Energy Progress;* **3**: No. 2, 76-79(Jun 1983).

Battelle's Columbus Laboratories has developed a proprietary process for treating coal with calcium compounds, called the Battelle Treated Coal process, in which the incorporated calcium produces an improved gasification feedstock. From the results of batch and continuous fixed-bed gasification testing of BTC the following conclusions were drawn: 1) 80-95% of the coal's sulfur can be captured in the coal ash, eliminating the need for gas desulfurization; 2) tar-free, very-low-oil fuel gas can be produced, greatly simplifying down-stream processing; 3) non-leachable sulfur containing ash, which can be disposed of in an environmentally acceptable manner, can be produced minimizing disposal problems; 4) a 185-200 Btu/SCF (including 175-190 Btu/SCF higher heating value plus sensible heat equivalent to at least 12 Btu/SCF) gas can be produced, minimizing boiler derating and retro-fitting problems; 5) mildly caking eastern coals can be rendered nonswelling and nonagglomerating, extending the range of coals acceptable for fixed-bed gasification; 6) the steam reactivity of BTC is greatly increased over the parent coal, which leads to increased gasifier throughput; 7) the ash-fusion temperatures are significantly increased compared to the raw coal, allowing higher temperature operation which produces less carbon dioxide, requires less steam, and minimizes potential clinkering and slagging problems; and 8) the hot fuel gas can be used directly, eliminating the need for cooling operations, increasing overall thermal efficiency, and eliminating the wastewater problem associated with treatment of the condensate collected from unreacted steam. 4 tables, 1 figure, 12 references

17965 **Coal catalysis expands gasifier application options.** Feldmann, H.F.; Conkle, H.N. (Battelle Columbus Lab., OH). *Energy Progress;* **3**: No. 2, 105-109(Jun 1983).

The feasibility of utilizing coal treated with CaO in a fixed-bed gasification system is evaluated for replacement of oil and natural gas for industrial and utility applications; replacement of flue gas desulfurization for coal burning utilities; and coal gasification/combined cycle power generation systems. 3 references, 1 figure, 2 tables.

17966 **(UCRL-Trans—11205) Use of a gas-steam combined-cycles generator set in the Belgian project for underground gasification under high pressure.** Patigny, J. Translated from *Annales des Mines de Belgique ;* No. 12, 1137-1167(Jan 1977). Contract W-7405-ENG-48. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009303. DE84009303

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The first part of this article sets out the main lines of the Belgian project for the underground gasification of coal. There are five major characteristics: gasification under high pressure (25 to 50 bars); cyclic variation of pressure; combination of underground gasification with methane recovery; recovery of the sensible heat of the product gas by water-cooling the producing boreholes; and integration of the process of underground gasification of coal in a combined-cycles (Brayton-Rankine) power plant. The second part of the article describes in detail the thermodynamic cycles to which the gasification air and the combustion air are subjected. The optimization of these cycles is then discussed. It is clear that the choice of a maximum pressure of the order of 25 to 50 bars is very advantageous, both from the point of view of the work done per kg of fluid and from that of thermal efficiency. 14 figures, 3 tables.

0105 By-products

REFER ALSO TO CITATION(S) 17925, 17984

17967 (EUR—7888-DE) Large pilot plant direct reduction trials Porto Alegre/Brazil - Bous/Saar (Report on ECSC contract 6210-XA/1/101). (Commission of the European Communities, Luxembourg). 1983. 191p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

Trials carried out at the pilot plant in Brazil on the direct reduction of iron ores using brown coal are reported. The transport of brown coal briquettes from West Germany to Brazil, direct reduction trials in the rotary kiln, sponge iron transport from Brazil to West Germany, and the melting of sponge iron in electric arc furnace are discussed. (In German)

17968 (EUR—8385-EN) An investigation of the factors affecting the composition and yields of tar and benzole produced by high temperature carbonization of coal (Report on ECSC contract 7220-EB/813). (Commission of the European Communities, Luxembourg). 1983. 51p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The effects of carbonizing variables in the 17-tonne BCRA experimental test facilities on the yields and concentration of liquid by-products have been studied. The three primary variables investigated were flue temperature, method of charging, and charge weight, but secondary to these variables was the free-space temperature which was studied by the multiple regression technique. A number of statistically significant effects were found and these are discussed in detail.

0106 Properties

REFER ALSO TO CITATION(S) 17920, 17942, 17943, 17948, 17954, 17958, 18002, 18027, 18028, 18029, 18287, 18288, 18289, 18290, 18819, 18921

17969 (ARL-TR—28) Study on the analysis of coals in the Atlantic region. (National Research Council of Canada, Halifax, Nova Scotia). 1981. 40p. (NRCC—19535). National Research Council of Canada, Halifax, Nova Scotia.

The expanding coal industry in Eastern Canada requires readily accessible analytical facilities to support the continuing growth of work in coal research, development and operations. This study assesses the current status of equipment, facilities and services that exist in Nova Scotia and New Brunswick for the analysis of coal and related materials both for routine analysis and for sophisticated research and development work. The study evaluates the possible need for a new analytical laboratory and the personnel required to operate such a facility.

17970 (DOE/PC/30013—T5) Calculation of calorific values of coals from ultimate analyses: theoretical basis and geochemical implications. Final report. Part 8. Given, P.H.; Weldon, D.; Zoeller, J.H. (Pennsylvania State Univ., University Park (USA)). Mar 1984. Contract AC22-80PC30013. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007965.

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The various formulae for calculating calorific values for coals from ultimate analyses depend essentially on a propositon due to Dulong, that the heat of combustion of an organic compound is nearly equal to the heats of combustion of the elements in it, multiplied by their percentage content in the compound in question. This proposition assumes that the enthalpy of decomposition is negligible compared with the heat of combustion. The various published formulae, such as that due to Mott and Spooner, include empirical adjustments to allow for the fact that the enthalpy of formation or decomposition of no organic compound is zero (except rarely by chance). A new equation is proposed, which excludes empirical correction terms but includes a term explicitly related to the enthalpy of decomposition. As expected from the behavior of known compounds, this enthalpy varies with rank, but it also varies at the same level of rank with the geological history of the sample: rank is not the only source of variance in coal properties. The new equation is at least as effective in predicting calorific values for a set of 992 coals as equivalent equations derived for 6 subsets of the coals. On the whole, the distributions of differences between observed and calculated calorific values are skewed to only a small extent. About 86% of the differences lie between -300 and +300 Btu/lb (+- 700 kJ/kg). 10 references, 7 figures, 4 tables.

17971 (DOE/PC/30145—T1) Analytical method for the evaluation of sulfur functionalities in American coals. Final report. Attar, A. (North Carolina State Univ., Raleigh (USA). Dept. of Chemical Engineering). May 1983. Contract AC22-80PC30145. 165p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84007770.

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This investigation consisted of the following 6 tasks: (1) improve the instrumentation for the sulfur functional groups analysis and make it more reliable. (2) create a set of reference standards of sulfur-containing compounds. (3) examine the sulfur groups distribution in untreated and desulfurized coals. (4) examine the sulfur functionalities in raw and processed coals, i.e., liquefied coals. (5) determine the distribution of sulfur functionalities in modified coals. (6) prepare computer programs for calculations related to the distribution of sulfur functional groups in coal. Each task is discussed and results are presented. Appendix A contains the computer program used to interpret the data. 31 references, 56 figures, 17 tables.

17972 (DOE/PC/40789—T9) Thermal and radiative properties of coal-ash deposits. Technical progress report No. 9, December 1, 1983-February 29, 1984. Anderson, D.W.; Vader, D.T.; Zumbrunnen, D.A.; Incropera, F.P.; Viskanta, R. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). 1984. Contract FG22-81PC40789. 32p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007383.

Two thermal conductance experiments on coal-ash deposits (II.D and II.E) have been performed in the High Temperature Test Facility in the last quarter. An attempt at a third experiment has been made. Ash deposits from the Purdue University power plant were studied in both of the successful experiments. Deposits were crushed and sized such that particle diameters of 250 to 590 m were retained. Results from an earlier experiment (II.C) using larger size particle (590 to 841 m) from the same ash deposit source have been discussed in Progress Report No. 8. The two most recent experiments were performed to determine the effects of smaller particles size and thermal history, and to check reproducibility of experimental apparatus and procedures. The conductance results from Experiments II.D and II.E show that the light sintering experienced in II.D did not produce any irreversible changes, and reproducibility between II.D and II.E is excellent. The high temperatures in II.E (maximum surface temperature of 1394°C) were well above the melting temperature of the slag, producing a melt layer approximately 5 mm thick. The melt layer is responsible for the irreversible thermal conductance curve. 3 figures.

17973 (ECN—83-155) Description of the TRACOR NORTHERN energy dispersive system as applied to coal minerals analysis. Hamburg, G. (Stichting Energieonderzoek Centrum Nederland, Petten). Sep 1983. 17p. Stichting Energieonderzoek Centrum Nederland (ECN), P.O. Box 1, NL-1755 ZG, Petten.

Since May 1982 a new energy dispersive X-ray system TRACOR NORTHERN TN 2000/4000 with a number of software programs is in use at ECN. A short description of this software is given and a more extended one of the coal mineral analysis (CMA).

17974 (ECN—83-172) Comparison between petrographic results of ECN and 11 other laboratories. Vitrinite reflectance, maceral analysis and coal blend composition. Vleeskens, J.M.; Roos, C.M. (Stichting Energieonderzoek Centrum Nederland, Petten). Oct 1983. 17p. Stichting Energieonderzoek Centrum Nederland (ECN), Petten.

Twelve laboratories took part in the 1982/1983 collaborative exercise of the working group on automated coal petrology which is part of the International Committee for Coal Petrology (ICCP). The number of data obtained on automated analysis was, for different reasons, not enough to make a meaningful evaluation of automated analysis methods. The somewhat larger number of manual analysis data, however, provided sufficient reference information to conclude that in all cases ECN data were well within the interlaboratory spread and, in most cases, also within the standard deviation of the combined results. (Available from ECN, PO Box 1, NL-1755 ZG Petten, The Netherlands).

17975 **(EUR—7963-EN) Characteristics of changes in large blast furnaces (Report on ECSC contract 7210-AA/401).** Barnaba, P.; Capriulo, R.; Marino, S. (Commission of the European Communities, Luxembourg). 1983. 113p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The effects of the chemical, physical and technological properties of the ferriferous materials and coke on the performance of a large blast furnace (hearth diameter 14 m) was investigated. Correlations were found between the properties of the charge and the main operating parameters of the blast furnace. The levels of quality of the sinter, pellets and coke needed to improve the blast furnace process were determined.

0108 Waste Management

REFER ALSO TO CITATION(S) 17931, 17987, 17989, 18408, 19081

17976 **(DOE/ET/11273—T1) Application of the SULF-X process to coal conversion and utilization. Phase II final report.** Shapiro, E.; Bramer, H.C.; New, R.A. (Pittsburgh Environmental and Energy Systems, Inc., PA (USA)). 1984. Contract AC01-78ET11273. 240p. NTIS MF A01. Order Number DE84004722.

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Pittsburgh Environmental and Energy Systems, Inc. contracted with the Department of Energy to demonstrate the efficacy of an iron sulfide flue gas treatment system (FGT) for removing sulfur dioxide (SO_2) and nitrogen oxides (NO/sub x/) and to correlate process variables to system performance. Laboratory and bench-scale testing was conducted with the SULF-X process, using both synthesized gas and actual flue gas from a coal-fired furnace. Laboratory tests resulted in 95% SO_2 removal and up to 95% NO/sub x/ removal. The bench-scale system demonstrated similar SO_2 removal efficiencies, but achieved only 39% NO/sub x/ removal due to relatively high oxygen concentrations in the flue gas and insufficient liquid-gas interfacial area within the absorber. Elemental sulfur was recovered during the regeneration steps. Total capital investment for the SULF-X system was estimated to be $91 to $103 per kilowatt (electric), compared to $90/kw for sodium solution scrubbing, $78 to $83/kw for magnesia slurry scrubbing and $74/kw for limestone slurry scrubbing. Annual operating costs for the SULF-X system were estimated to be 5.44 to 6.90 mills per kilowatt-hour, compared to 4.96 to 5.22 for sodium, 3.68 to 3.99 for magnesia and 3.73 to 4.25 for limestone. 6 references, 6 figures, 9 tables.

17977 **(DOE/ET/15492—T47) Laboratory/bench scale testing and evaluation of A.P.T. dry plate scrubber. Sixteenth quarterly progress report, December 1, 1983-February 29, 1984.** (Air Pollution Technology, Inc., San Diego, CA (USA)). 21 Mar 1984. Contract AC21-80ET15492. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009053.

The objective of this project is to conduct a bench scale experimental evaluation of the dry plate scrubber (DPS) at high temperature and pressure to determine its potential for controlling particulate and alkali vapor emissions from PFBC processes. This project is divided into two phases and eight major tasks as listed in Table 1. Phase I is a preliminary study consisting of a theoretical review, preliminary particle collection experiments and preliminary alkali sorption experiments. The purpose of Phase I is to provide specific design criteria for Phase II. Phase II is a bench scale evaluation of the DPS at high temperature (900°C) and pressure (1000 kPa). The bench scale DPS will be designed and evaluated for both particulate matter and alkali vapor control. A detailed process design of a DPS sub-pilot plant installed at a PFBC facility will be made. The process economics will be evaluated in terms of capital and operating costs as a function of cleaning efficiency. The technical objectives for this quarter were to: (1) Complete all HTP-DPS experiments. (2) Complete fabrication and installation of DPS test section for studying prevention of ash cake accumulation. (3) Start process design for PFBC-DPS system.

17978 **(DOE/FE/60088—T1) Physics and chemistry of E-beam stack gas processing. Final report, 20 September 1982-14 January 1984.** Slater, R. (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Oct 1983. Contract AC22-82FE60088. 123p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84008320.

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The purpose of this program is to investigate some of the basic physics and chemistry of the electron beam induced NO/sub x/ and SO/sub x/ removal process. The program involves both kinetic modelling and diagnostic development. The development of an adequate kinetic model is necessary in order to scale the laboratory results, which are currently available, to process conditions closer to those that will be encountered at full scale operation. It is also necessary in order to place the laboratory data on a firm theoretical foundation. The development of real time optical diagnostics is a necessary supporting task for these goals in order to obtain kinetic data on some of the myriad of species that are present in this hostile environment (X-rays present; hot, acidic gas) which is difficult to access by conventional methods. This particular NO/sub x//SO/sub x/ removal process involves the irradiation of combustion products t temperatures around 100°C with a beam of high energy electrons. The current study expands upon the mechanistic studies. A detailed kinetic model is described which includes all the necessary assumptions that enter in order to take the very large number of possible processes that occur in e-beam irradiated mixtures and reduce them to some tractable number. Quantitative comparisons are then made between the kinetic model and experimental data. Another phase of this program is the development of laser diagnostics to probe various species in the irradiated flue gas. The experimental phase of program is first described including a discussion of our e-beam facility and the methods used to accurately measure energy deposition. A description of the laser diagnostics follows. 37 references, 22 figures, 7 tables.

17979 **(DOE/FE/60181—31) Impact of fly ash composition upon shaker baghouse efficiency.** Sears, R.; Miller, S.J. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Mar 1984. Contract FC21-83FE60181. 24p. (CONF-840612—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008163.

From Air Pollution Control Association annual meeting; San Francisco, CA, USA (25 Jun 1984).

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Many parameters can have major effects on fabric filter performance. The most extensively published research in fabric filtration has concentrated on baghouse related parameters such as fabric type, cleaning mode, cleaning cycle, and air-to-cloth ratio. To a lesser extent studies have considered ash characteristics such as particle size distribution and specific filter resistance coefficient, K_2. Little research has been reported relating coal or ash properties to fabric filter performance. This paper deals with penetration from a shaker chamber with one specific fabric. The independent variable is major element concentration in fly ash. Air-to-cloth ratios varied only because combustion conditions control flue gas volumes. Results indicate that first, fabric filter performance is indeed coal specific with large differences in removal efficiency with different ashes. Second, the results reveal a definite inverse correlation between penetration and sodium concentration in the fly ash for the fabric and cleaning configuration considered. For the ashes that demonstrate poor performance in tests, careful selection of the correct fabric together with a conservative air-to-cloth ratio and the optimum cleaning cycle may all be necessary in order to maintain an adequate residual dust cake and bring the efficiency up to an ac-

ceptable level. Heavy dust cake formation may be necessary to achieve high efficiencies with these coals. Residual dust cake for the coals that showed high efficiencies in these tests may not be important, since North Dakota lignites give excellent efficiencies immediately after starting with new bags. Apparently the latter ashes build up on the woven fabric layer in such a way that openings in the weave and pinholes are immediately bridged over. These coals may then be candidates for high ratio filtration with conventional, economical woven fabric. 28 references, 10 figures, 4 tables.

17980 **(DOE/PC/30232—T8) Pollutants from coal conversion processes. Final technical report, September 1, 1980-August 31, 1983.** Felder, R.M.; Ferrell, J.K. (North Carolina State Univ., Raleigh (USA). Dept. of Chemical Engineering). 1983. Contract FG22-80PC30232. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007313.

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A devolatilized Kentucky bituminous coal, a North Carolina peat, and a New Mexico subbituminous coal have been gasified with steam and oxygen in a pilot-scale fluidized-bed reactor. The reactor was operated at pressures of 570 to 840 kPa (80 to 120 psia), molar steam-to-carbon feed ratios of 0.6 to 1.9, and average bed temperatures of 795 to 1010°C (1460 to 1850°F). The coal feed rate ranged from 14 to 33 kg/h (30 to 73 lb/h). The reactor effluents were analyzed for major components and potentially hazardous minor components using gas chromatography; tars and wastewaters condensed from the product were analyzed using gas chromatography/mass spectroscopy, capillary column gas chromatography, and high pressure liquid chromatography; and the feed coals, spent chars, and condensed phase streams were analyzed for selected trace metals using atomic absorption spectrophotometry. The experimental results were used to provide a basis for the formulation and evaluation of a mathematical model of the gasifier. The model assumes instantaneous devolatilization of coal at the top of the fluidized-bed, instantaneous combustion of carbon at the bottom of the bed, and steam/carbon gasification and water gas shift reaction in a single perfectly mixed isothermal stage. The effects of various operating parameters and phenomena on reactor performance were determined using the model. As would be expected, carbon conversion and make gas production both increase with bed temperature, steam-to-carbon feed ratio, and solid-phase space time. Both also go up with pressure, but above about 1.7 MPa the increases are negligible. At the temperatures studied, the water-gas shift reaction falls short of equilibrium for pressures lower than 2.1 MPa (confirming experimental results), but the reaction is close to equilibrium at pressures above this value. 25 references, 16 figures, 11 tables.

17981 **(DOE/PC/60262—T1) Advanced combined NO/sub x//SO/sub x/ removal system. Monthly technical progress report, January 1-31, 1984.** (Rockwell International Corp., Canoga Park, CA (USA)). 1984. Contract AC22-83PC60262. 5p. NTIS, PC A02; 3; GPO Dep. Order Number DE84006833.

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Progress report for Task 1 catalyst selection and characterization is presented. The assembly of the fixed-bed reactor system was completed. Feed or product samples were analyzed with a thermoelectron model 40 pulsed fluorescence analyzer in SO_2 sorption tests. For NO reduction tests, the determination of NO, NO_2, and NH_3 concentrations in the gas streams was accomplished with two thermoelectron chemiluminescent model 10A analyzers. Catalysts, alumina-base pellets containing copper in the form of copper oxide, were evaluated for SO_2 sorption and NO reduction. 5 figures.

17982 **(DOE/PC/60262—T2) Advanced combined NO/sub x//SO/sub x/ removal system. Monthly technical progress report, December 1-31, 1983.** (Rockwell International Corp., Canoga Park, CA (USA)). 1983. Contract AC22-83PC60262. 10p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007333.

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Work accomplished in December for Task 1, catalyst selection and characterization, is presented. The assembly of the fixed-bed reactor system was carried out and is now 90% complete. Copper sorbents/catalysts were prepared using Davison gamma alumina supports in 2 sizes: 5 x 8 mesh and 8 x 14 mesh spheres. Preparation of a third catalyst with Davison 12 x 25 mesh alumina spheres is being prepared.

17983 **(EUR—8329-DE) Use of washery refuse in building and civil engineering applications (Report on ECSC contract 7220-EC/112).** Schieder, T.; Erdmann, W.; Leininger, D. (Commission of the European Communities, Luxembourg). 1983. 61p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The production of lightweight concrete blocks using fired spoil instead of pumice; production of lime-bound, vapour-hardened masonry bricks using crushed unfired coarse washery tailings instead of quartz sand; the use of fired unbound spoil as a frost blanket and base course; use of fired bitumen-bound spoil as a base course; and use of unfired water-bound spoil as a base course were all investigated. (In German)

17984 **(EUR—8386-FR) Treatment of carry-over material in modern coking plants (Report on ECSC contract 7220-EB/316).** (Commission of the European Communities, Luxembourg). 1983. 32p. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

A method of treatment enabling the best possible use to be made of coking plant carry-over material was developed. Only preheated charges were examined. By-products that could be used in a coking plant were obtained, and another method uses the carry-overs as a fuel. (In French)

17985 **(EUR—8388-FR) Study to improve the performance of activated carbon in treating malodorous gaseous effluents (Report on ECSC contract 7220-EC/307).** (Commission of the European Communities, Luxembourg). 1983. 41p. (In French). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

To improve the performance of activated carbon, the following were examined: impregnating the carbon with an acid; ozonization of the effluent prior to adsorption; prior impregnation of the carbon with an oxidation catalyzer; biological regeneration (which was unsatisfactory); and use of low-activated carbons. (In French)

17986 **Characterisation of covalent constituents in a coal conversion solid waste.** Hoffman, W.A. Jr.; Lindberg, S.E.; Turner, R.R. (Oak Ridge National Lab., TN). *Environmental Pollution, Series B: Chemical and Physical;* **4**: 219-229(1982). Contract W-7405-ENG-26.

A solid waste derived from the gasification of solvent-refined coal (SRC-II) mineral residue contained both elemental sulfur (S^0) and organic compounds. These constituents were extracted directly from the waste with dichloromethane. Free sulfur comprised ~1% by weight of the waste. The organic compounds identified - conjugated carbon ring systems with molecular weight below and including anthracene - were below 0.001% levels. On equilibration with water, concentrations of dissolved or suspended organic compounds reached a maximum in about 1 h and then decreased with time. Organic compounds present do not appear to have a metal-active functional groups that would contribute significantly to ion mobility in the waste under leaching conditions. 4 figures, 1 table.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 17928, 18007, 18040, 19026, 19035, 19094

17987 (CONF-821048—10) Solid waste management. Status report. Francis, C.W.; Wobber, F.J. (Oak Ridge National Lab., TN (USA); USDOE Office of Energy Research, Washington, DC. Office of Health and Environmental Research). 1982. Contract W-7405-ENG-26. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84001951.

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

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Research results pertaining to potential health and environmental consequences of solid wastes produced by operating commercial-sized coal conversion plants were reviewed and evaluated. Some of these wastes contain toxic metals as well as mutagenic and carcinogenic organic compounds. The major problem, however, is not the acute toxicity or carcinogenicity of the wastes, but rather the generation of solid waste leachates from the large volume of wastes, predominantly coal preparation wastes and gasifier ashes and slags. The most troublesome wastes appear to be those containing reduced forms of sulfur. When disposed of in landfills, these wastes will, with age and oxidation of sulfur, generate acidic leachates. These leachates will likely contain concentrations of toxic contaminants, such as Cu, Pb, Cd, Ni, etc., that will overtax natural attenuation or dispersal mechanisms, resulting in their harmful accumulation in surface and groundwater as well as in other sensitive areas of the environment. Some of the organic wastes, such as electrostatic precipitator tars and oily sludges from wastewater treatment, are potential health hazards relative to their exposure at the coal conversion facility and to their handling en route to disposal sites. Further health and environmental research is needed to identify the risks associated with exposure to the work force as well as exposure to the general population as a consequence of landfill disposal practices. Health research should concentrate on investigating the effects of inhalation, contact with skin, and ingestion of wastes. Environmental research should address questions regarding long-term disposal. The major research goal should be the prediction of solid waste leachate movement in subsurface environments.

17988 (DOE/PC/30246—1557) Adsorption of polycyclic aromatic hydrocarbon compounds onto soil and transport of naphthalene in unsaturated porous media. Fu, J.K.; Luthy, R.G.; Dzombak, D.A. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Aug 1983. Contract FG22-80PC30246. 199p. NTIS, PC A09/MF A01; GPO Dep. Order Number DE84003089.

This study evaluated procedures for estimating adsorption of polycyclic aromatic hydrocarbons (PAH) onto soil from knowledge of soil organic carbon content and physico-chemical properties or structural characteristics of PAH. The study also entailed an experimental investigation to observe the manner in which naphthalene moves through unsaturated soil. It was found that an approximate value for adsorption coefficients for PAH onto soil can be obtained from readily available physico-chemical properties or structural characteristics for PAH, and correlation with information on soil organic carbon content. A laboratory apparatus was assembled in order to observe organic solute transport through unsaturated porous media, and laboratory experiments were performed to evaluate transport of naphthalene in unsaturated soil. Two tests were performed of approximately fifty days duration each. The tests were configured to observe naphthalene adsorption and breakthrough, followed by observations on naphthalene desorption characteristics. Naphthalene breakthrough was observed in tests with sterilized soil, and approximately 60% of naphthalene applied to the column was eventually eluted during desorption. This value of retardation coefficient compared favorably to that which was predicted from determination of naphthalene adsorption coefficient. Hydrodynamic dispersion coefficients were determined for transport of both chloride ion and naphthalene under conditions of both step increase and step decrease in concentration. The experimental portion of this investigation evaluated transport through unsaturated soil because groundwater contamination problems often originate in the unsaturated zone, and because relatively little information exists regarding the manner in which organic solutes are transmitted through this zone to the water table. 115 references, 22 figures, 20 tables.

17989 (KFK—3523) Consequences of an expanded use of coal in the Federal Republic of Germany: pollutant emissions from coal conversion. Juenten, H.; Van Heek, H.; Hewing, G.; Klein, J.; Peters, U.; Schroeter, H.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Mar 1983. 108p. Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.

In this report, first the market potentials and the time horizon for market introduction of coal gasification and liquefaction are discussed. The basic concepts of coal gasification and liquefaction are described, followed by a discussion of the environmental impacts of coal conversion. For gaseous emissions, estimates are presented. A further section of this report deals with the problem of waste water treatment. The report is preceded by a summary version.

17990 (PB—84-137439) Biological and hydrological impacts of surface mining for federal minerals on the Tyro Creek watershed, Alabama. Phase 1. Priming-aquatic baseline information. Report for September 1981-September 1982. Harris, S.C.; O'Neil, P.E.; Chandler, R.V.; Mattee, M.F.; McCullough, E.J. (Alabama Geological Survey, University (USA)). Oct 1982. 105p. NTIS, PC A06/MF A01.

This report is a compilation of water quality, hydrological, and biological information collected for four sites in the Tyro Creek watershed (Tuscaloosa County, Alabama) prior to surface mining for federal coal in the Little Tyro Creek lease tract. Samples were collected monthly from September 1981 through September 1982. This information provides a preliminary data base to assess hydrological and aquatic biological effects of surface mining and subsequent reclamation. These effects included high specific conductance, low pH, high sulfate and manganese concentrations, and increased sediment load.

17991 (PB—84-139807) Coal river: an educational alternative futures wildland and resource management planning game. Stone, E.L. (Bureau of Land Management, Denver, CO (USA)). Oct 1979. 20p. (TN—339). NTIS, PC A02/MF A01.

The Coal River game presented here is a version of a game 'Mystic Mountain', developed by USDA, Pacific Southwest Forest and Range Experiment Station. Mystic Mountain is described as an educational game which teaches wildland planners and managers important concepts in alternative futures planning while they attempt to manage a hypothetical national forest for 75 years (five fifteen year periods). Coal River builds on this basic concept, however instead of having competing uses of camping, primitive recreation activities, skiing, timber production and spiritual values, this game deals with managing (1) coal mining by surface methods, (2) primitive recreation activities, (3) camping, (4) river floating and (5) domestic livestock and wild horse forage production. The game is played for five 15 periods, in which the players attempt to meet different competing use production targets under various alternative future scenarios.

17992 (USGS-OFR—82-105) Hydrology of potential mining areas in the Warrior coal field, Alabama. Puente, C.; Newton, J.G. (Geological Survey, Tuscaloosa, AL (USA)). 1982. 147p. NTIS, PC A07/MF A01. Order Number DE84900470.

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Hydrologic data for four small basins and for numerous other sites in the Warrior coal field are used to define the potential impact of surface mining on water resources. Bear and Blue Creek basins are underlain predominantly by relatively impermeable consolidated rocks in the Pottsville Formation. Turkey and Yellow Creek basins are underlain predominantly by permeable unconsolidated rocks in the Coker Formation. With the exception of locally objectional concentrations of dissolved iron and manganese, ground water in the basins is suitable for most uses. Streamflow distribution reflects seasonal precipitation. Storm runoff is characterized by

concentrated peakflows of short duration that rapidly recede to low flow. Streams draining basins underlain mainly by the Pottsville Formation frequently go dry, whereas those draining basins underlain chiefly by the Coker Formation have well-sustained low flows. Surface water is generally acidic and low in dissolved solids. Water in streams draining basins underlain chiefly by the Pottsville Formation is slightly more mineralized and less acidic than water in streams draining areas underlain chiefly by the Coker Formation. Climatic, physiographic, hydrologic, and land-use data are analyzed by regressions to derive relations for estimating water quality in streams draining mined and unmined areas. The impacts of mining on the hydrologic systems are identified as increased erosion and sedimentation, baseflow augmentation, decline in groundwater levels, and degradation of water quality. A digital model was calibrated to simulate streamflow for Bear, Blue, and Yellow Creeks under unmined conditions and mined conditions permitting a general examination of surface-water characteristics (quantity and quality), and estimation of hydrologic impacts that will result from surface mining. 40 references, 27 figures, 11 tables.

17993 **Application of electron beam technology to particulate matter control.** Finney, W.C.; Clements, J.S.; Davis, R.H.; Tokunaga, O.Z. (Florida State Universty, Tallahassee, Florida). *Proceedings, Annual Meeting, Air Pollution Control Association;* 82-27.4: 19(Jun 1982). Contract AC22-81MC16229.

Electron beam ionization as a replacement for corona-wire ionization in electrostatic precipitators is discussed in this paper. The F.S.U. electron beam precipitator, capable of testing the concept of electron beam ionization on a variety of resuspended aerosols, is being studied. The research program outlined in this paper will concentrate on particle charging and collection efficiency with a mention of modifications to the EBP which would make possible an investigation of the combined removal of SO_x, NO /SUB x/ , and particulate matter. Bench-scale experiment and field test results are given.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 17992, 19224

17994 **(USGS-CIRC—891) Coal resource classification system of the US Geological Survey.** Wood, G.H. Jr.; Kehn, T.M.; Carter, M.D.; Culbertson, W.C. (Geological Survey, Reston, VA (USA)). 1983. 62p. USGS, 604 South Pickett St., Alexandria, VA 22304.

The definitions, criteria, guidelines, and illustrations are designed to aid coal geologists and engineers in preparing their reports by providing guidance in calculating, categorizing, and describing the coal resources/reserve base/reserves they are evaluating. The description of geophysical log usage also should provide aid in obtaining and using subsurface information on the areal extent, thickness, and correlation of coal beds and should open up a vast and generally untapped data source for most coal geologists. Adherence to the categories of resource assignment, to the definitions, and to the criteria can result in more accurate, precise, explicit, and consistent reports. The classification system and terminology described are equally applicable to hand and computer system determinations of resources and reserves. The illustrations are applicable to manual methods of coal resource/reserve base/reserve tonnage estimations. Computer programs have been designed that will yield similar tonnage estimates of coal resources. Those wishing to inquire about the computer software and methodologies should write to Chief, Branch of Coal Resources, 956 National Center, US Geological Survey, Reston, Virginia 22092.

0120 Mining

REFER ALSO TO CITATION(S) 18039

17995 **(CAPE—2931) Preliminary design plans (Engineering Materials).** (Underground Systems, Arcadia, CA (USA)). 8 Mar 1984. Contract FG01-82CE15130. TIC. Order Number DE84009174.

7 35-mm aperture cards.

Part of the Final Report on the subject grant consists of Roll 1 of reverse cepia drawings. They are bound in groups. Each group represents a specific hardware assembly pertinent to the mining technique discussed. It is suggested that the sheets comprising each group be kept intact and not allowed to become mixed up with drawings of another group. For example, there are two types of RIGS proposed and important to the mining technique. They differ to a considerable degree in their design and functional requirements. The Mining Rig is covered by drawings under Assemblies 1.1 through 1.8. The Pilot Hole Drilling Rig is covered by drawings under the Assembly number of 14.0.

17996 **(CAPE—2932) Assembly drawings 1.1-1.8 full bore mining rig (Engineering Materials).** (Underground Systems, Arcadia, CA (USA)). 22 Nov 1983. Contract FG01-82CE15130. TIC. Order Number DE84009173.

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Part of the Final Report on the subject grant consists of Roll 2 of reverse cepia drawings. They are bound in groups. Each group represents a specific hardware assembly pertinent to the mining technique discussed. It is suggested that the sheets comprising each group be kept intact and not allowed to become mixed up with drawings of another group. For example, there are two types of RIGS proposed and important to the mining technique. They differ to a considerable degree in their design and functional requirements. The Mining Rig is covered by drawings under Assemblies 1.1 through 1.8. The Pilot Hole Drilling Rig is covered by drawings under the Assembly number of 14.0.

17997 **(CAPE—2933) Assembly drawings: 2.1 support collars, 2.2 anchor collars.** (Underground Systems, Arcadia, CA (USA)). Sep 1983. Contract FG01-82CE15130. TIC. Order Number DE84009172.

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Part of the Final Report on the subject grant consists of Roll 3 of reverse cepia drawings. They are bound in groups. Each group represents a specific hardware assembly pertinent to the mining technique discussed. It is suggested that the sheets comprising each group be kept intact and not allowed to become mixed up with drawings of another group. For example, there are two types of RIGS proposed and important to the mining technique. They differ to a considerable degree in their design and functional requirements. The Mining Rig is covered by drawings under Assemblies 1.1 through 1.8. The Pilot Hole Drilling Rig is covered by drawings under the Assembly number of 14.0

17998 **(CAPE—2934) Assembly drawings: 3.1 drive steam assembly, 4.1 mining head, 5.1 coal and gas gathering and transfer system.** (Underground Systems, Arcadia, CA (USA)). Oct 1983. Contract FG01-82CE15130. TIC. Order Number DE84009171.

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Part of the Final Report on the subject grant consists of Roll 4 of reverse cepia drawings. They are bound in groups. Each group represents a specific hardware assembly pertinent to the mining technique discussed. It is suggested that the sheets comprising each group be kept intact and not allowed to become mixed up with drawings of another group. For example, there are two types of RIGS proposed and important to the mining technique. They differ to a considerable degree in their design and functional requirements. The Mining Rig is covered by drawings under Assemblies 1.1 through 1.8. The Pilot Hole Drilling Rig is covered by drawings under the Assembly number of 14.0

17999 **(CAPE—2935) Assembly drawings: 10.0 pilot hole drill string assembly, 12.0 probe hole drilling assembly.** (Underground Systems, Arcadia, CA (USA)). Jul 1983. Contract FG01-82CE15130. TIC. Order Number DE84009170.

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Part of the Final Report on the subject grant consists of Roll 5 of reverse cepia drawings. They are bound in groups. Each group represents a specific hardware assembly pertinent to the mining technique discussed. It is suggested that the sheets comprising each

group be kept intact and not allowed to become mixed up with drawings of another group. For example, there are two types of RIGS proposed and important to the mining technique. They differ to a considerable degree in their design and functional requirements. The Mining Rig is covered by drawings under Assemblies 1.1 through 1.8. The Pilot Hole Drilling Rig is covered by drawings under the Assembly number of 14.0 (Roll 1)

18000 **(CAPE—2936) Probe/pilot hole drill rig.** (Underground Systems, Arcadia, CA (USA)). Jan 1984. Contract FG01-82CE15130. TIC. Order Number DE84009169.

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Part of the Final Report on the subject grant consists of Roll 6 of reverse cepia drawings. They are bound in groups. Each group represents a specific hardware assembly pertinent to the mining technique discussed. It is suggested that the sheets comprising each group be kept intact and not allowed to become mixed up with drawings of another group. For example, there are two types of RIGS proposed and important to the mining technique. They differ to a considerable degree in their design and functional requirements. The Mining Rig is covered by drawings under Assemblies 1.1 through 1.8. The Pilot Hole Drilling Rig is covered by drawings under the Assembly number of 14.0. (Roll 1)

18001 **(CAPE—2937) Drill pipe magazine.** (Underground Systems, Arcadia, CA (USA)). 13 Jul 1983. Contract FG01-82CE15130. TIC. Order Number DE84009168.

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Part of the Final Report on the subject grant consists of Roll 7 of reverse cepia drawings. They are bound in groups. Each group represents a specific hardware assembly pertinent to the mining technique discussed. It is suggested that the sheets comprising each group be kept intact and not allowed to become mixed up with drawings of another group. For example, there are two types of RIGS proposed and important to the mining technique. They differ to a considerable degree in their design and functional requirements. The Mining Rig is covered by drawings under Assemblies 1.1 through 1.8. The Pilot Hole Drilling Rig is covered by drawings under the Assembly number of 14.0 (Roll 1).

18002 **(CSIRO-DAG-GCM—42) An hypothesis to predict the strength of banded coal pillars at Westfalen No. 3 Colliery, Ipswich, Queensland.** Schlanger, H.P.; Enever, J.R.; Tsaganas, S.; Kelly, P. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1983. 53p. Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Victoria, Australia.

An hypothesis has been put forward to explain the net strength of banded coal. Laboratory tests were performed on component materials in unconfined compression and direct shear, and on composites in unconfined compression. Good agreement was obtained between the theoretical strength prediction and experimental strength data of composite samples. Application of the model to in situ pillars gave an approximate linear relationship between pillar strength and fraction of stone bands within the vertical pillar section. This enabled a stability analysis on standing pillars at Westfalen. Pillar design charts based on the current stability of Westfalen pillars have been constructed and are suggested for use in future design.

18003 **(CSIRO-DAG-GCM—46) A study of the behaviour of a bolted coal mine roof subject to medium/high horizontal stress. Part 1: 2.1 metre long resin anchored bolts.** Walton, R.J. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1983. 64p. Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Victoria, Australia.

The results of an intensive field monitoring programme to study the actual behaviour of a rock bolt supported coal mine roof are described. The behaviour of sections of the roof in two roadways of different orientation, together with the performance of the 2.1 m long, resin anchored roof bolts used to stabilize the roof were studied at Tahmoor Colliery, N.S.W., Australia. A stress programme at three locations determined that the maximum principal stress was orientated approximately north-south and had a magnitude approximately twice that of the vertical stress. The CSIRO Hollow Inclusion stress measurement gauge was successfully employed to obtain these measurements. The difference in behaviour of the roof at each site was determined by measuring the roof deflection with a flexible sonic probe multiple position borehole extensometer. At one site, buckling of thin layers of roof rock appeared to be initiated by the horizontal stress. Eventual failure of some of these rock segments produced significant roof deformation in and above the roof bolt anchorage horizon. The effectiveness of the roof bolts was studied by measuring the load induced in the ungrouted section of specially strain gauged bolts. The amount of bending of this section could also be calculated and the early onset of yield in the bolt steel is discussed.

18004 **(CSIRO-DAG-GCM—47) A study of the effects of an overburden blast on the structure of a newly formed highwall at Blackwater Strip Coal Mine, Queensland.** O'Regan, G.J.; Boyd, G.; Cox, R.H.T.; Nguyen, V.V. (Commonwealth Scientific and Industrial Research Organization, Mount Waverley (Australia). Div. of Applied Geomechanics). 1983. 77p. Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Victoria, Australia.

The structural effects of a production blast on the overburden material immediately adjacent to a blast area were studied using surface and sub-surface techniques. These included conventional surveying; core logging; highwall mapping; seismic surveys; and down-hole measurements using extensometers, shear strips and electric piezometers. The initiation of the blast was recorded on high speed film. A significant increase in vertical and horizontal fracture frequency was recorded after the blast. The extent of fracturing into the highwall was dependent on the structural and lithological characteristics of the various units and the position of the explosive charges. A shallow zone of disruption to a depth of ten metres and lateral extent of around thirty metres from the newly formed highwall crest was recorded. Horizontal fractures were recorded by shear strips in the lower units of the overburden sequence at a maximum distance of fifty metres from the new highwall face. Possible fracture mechanisms in the adjacent highwall and the effect of these blast-induced fractures on highwall stability is discussed. Modifications to the present blast design for minimising highwall damage in stability sensitive areas are suggested.

18005 **(DOE/CE/15130—T4) Remote controlled underground mining system preliminary design and concept plans. Final report.** Haspert, J.C. (Underground Systems, Arcadia, CA (USA)). Mar 1984. Contract FG01-82CE15130. 221p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84009175.

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The proposed mining technique has the potential to mine coal from underground horizontal or pitching seams in the 9-foot thickness range at an estimated cost ranging from $7.987 to $10.152 per ton. The estimate is established on conclusions drawn from: (1) the anticipated mining rate, in terms of tons per hour, that the mining system's hardware is expected to achieve as an average; (2) the approximate cost of the mining hardware amortized on a production service life expectancy of 4,000,000 tons; (3) logistics pertinent to continuous mine production, requiring the operation of two Mining Rigs simultaneously with operating crews totaling to 9 men per shift; (4) the angle of the mine bores into pitching seams extend, whenever possible, to no more than 30° from the horizontal; (5) mine bores extend to maximum feasible or permissible length. A bore length of 2500 feet is considered feasible; and (6) gas recovery from the mine bores can be accomplished with relative ease. The value of this, however, has not been determined since its handling as a recoverable requires investigation on hardware assemblies necessary to its processing, and the volume that must exist to invite a commercially attractive effort.

18006 (DOE/EI/10577—T3) Development of underground mine cost estimating equations. Final report. (McLean Research Center, Inc., VA (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA)). 6 Mar 1981. Contract AC01-79EI10577. 143p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84007306.

Labor productivity is the single most important factor in determining initial and deferred capital and operating costs for an underground coal mine with fixed output requirements. The logic behind this statement is straightforward; productivity determines the number of operating sections required to produce a given tonnage which in turn dictates costs. In the past (prior to 1969) the common logic was that productivity was determined primarily by the physical conditions of the mine and the degree of mechanization. Starting in the late 1960's, however, the coal industry entered into a period of rapid change. The coal market that was stagnant for several decades began to expand resulting in a large influx of young, inexperienced workers into the ranks of both management and labor. Labor-management stability which existed throughout the 1950's and most of the 1960's ended with a series of contact and wildcat strikes. Dramatic changes also occurred within the mining system itself as a new stringent federal health and safety regulations were enacted. Lastly, as the industry expanded, underground operations expanded into heretofore uneconomical coal seams. This move into thinner seams and/or areas of poor roof and bottom conditions required that additional time be spent on preparation activities which, in turn, slowed the rate of production. In addition, higher coal prices shifted coal industry emphasis away from further mechanization and towards more labor intensive activities. Figures 3.1, 3.2, and 3.3 summarize the results of a recently completed productivity analysis conducted by a team of consultants fron SRC, Emory Ayers Association and Mathtech, Inc.

18007 (DOE/EV/04946—6-App.3) Environmental effects of contour coal strip mining. Hydrologic impact summary report. Appendix III. Tschantz, B.A.; Frederick, B.J.; Minear, R.A.; Dickens, P.S. (Tennessee Univ., Knoxville (USA). Dept. of Civil Engineering). Dec 1982. Contract AS05-76EV04946. 98p. NTIS, PC A05/MF A01. Order Number DE84001250.

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The results from this study demonstrate the great potential for steep back-to-approximate-contour slopes to generate large quantities of heavy and suspended sediment. Regulatory policies toward reclamation practices should provide adequate flexibility and necessary incentives to the coal mining industry to test innovative methods for reducing environmental damage from placement of spoil material. The long, steep slopes produced by back-to-approximate-contour reclamation invite predictably unstable slopes and heavy sediment yields. 25 references, 9 figures, 3 tables.

18008 (DOE/EV/10315—T1) SMCRA Coal Mining Permitting Program. (Hart (Fred C.) Associates, Inc., Washington, DC (USA)). 5 Dec 1983. Contract AC01-81EV10315. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007418.

The Department of Energy, as the federal agency responsible for the formulation of a national energy program consistent with national economic, environmental and social goals, has a direct interest in the factors affecting coal supply. The SMCRA permit acquisition process is one of these factors that has a potential effect on the quantity of coal available in the market. This effect could take the form of a permit not being issued, special conditions on a permit, a delay in the permit acquisition process, or a decision by an operator not to pursue mining of coal because of the compliance costs. These types of effects would result in a reduced supply of coal due to the exclusion of coal from mining, reduced quantities of mines coal, or a delay in mining the coal. DOE asked Fred C. Hart Associates, Inc. to examine the mining and reclamation permit application preparation and review process. This report summarizes the methodologies used to conduct the study, the history of SMCRA and OSM programs, the steps in the process, and the status of state programs.

18009 (EUR—7775-DE) Climate control under high rock temperature and high output conditions (Report on ECSC contract 7220-AC/105). Voss, J.; Chatel, P.; Glodek, E.; Schlotte, W.; Schmitters, G. (Commission of the European Communities, Luxembourg). 1983. 120p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

FGK (Forschungsstelle fuer Grubenbewetterung und Klimatechnik) has drawn up some completely new and some improved programmes for predicting climate and, on the basis of measurements made in winning and driving areas, has determined the data needed to make sufficiently accurate quantitative calculations. Improved measuring instruments, in particular for determining the amount of heat given off from electrical power units, were developed. Lastly, tests were carried out on air coolers which showed how further improvements could be made to these particularly important components of the ventilation system. (In German)

18010 (EUR—7776-DE) The control of firedamp in high-output workings (II) (Report on ECSC contract 7220-AC/106). Meiners, H.; Von Treskow, A.; Paul, K.; Koppe, U.; Duepre, G.; Sterzing, W. (Commission of the European Communities, Luxembourg). 1983. 170p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

Methane kinetics in seams and in country rock strata influenced by adjacent workings, the relationship between the gas content of the seam and stratigraphic and tectonic factors, gas emission in high-output workings, gas emission in high-speed drivages, and a process control computer system were all investigated. (In German)

18011 (EUR—8374-DE) Planning and operational practice for faces encountering geological faults (Report on ECSC contract 7220-AD/116). Claes, F. (Commission of the European Communities, Luxembourg). 1983. 45p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

Increased mechanisation has meant that the effects of geologic and tectonic faults are now more critical. 'Fault forms' were used to make a detailed investigation of a limited number of instances of working through faults. 'Faults documents' based on mine maps, operational monitoring values and measures taken, were also used. A fault catalogue was compiled and the basic principles of mining methods when working through faults were drawn up. (In German).

18012 (EUR—8376-EN) The improvement of face ends (Report on ECSC contract 7220-AD/811). (Commission of the European Communities, Luxembourg). 1983. 249p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The study of improvements of face ends was in 3 well-defined areas; it started with a full-scale surface simulation, moved to a one-tenth scale-model investigation and ended with mathematical modelling, using a computerized interactive graphics technique. The surface simulation covered several systems of pack placing, packhole and roadhead supports, together with different gate loading machines.

18013 (EUR—8378-EN) Advanced technology mining for longwall coalfaces (Report on ECSC contract 6220-AD/8/804). (Commission of the European Communities, Luxembourg). 1983. 19p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The major elements of advanced mining technology are: remote application techniques and equipment, extraction techniques, heavy duty equipment, all leading to improved safety at work. Remote control was applied to powered support operation, conveyor advance, and automatic steering and remote indication of position of power loaders. Extraction techniques refer to wider web working, thicker seam extraction of roof coal normally left during working and increased use of retreat mining. Some of the steps taken in the development of remote application techniques at coal mines in the UK are described.

18014 **(EUR—8430-DE) Optimization of winning methods and development of new apparatus (II) (Report on ECSC contract 7220-AD/114).** (Commission of the European Communities, Luxembourg). 1983. 256p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

Various disc cutters and drums were investigated and compared. The suitability of discs as cutting tools for discs was established and a prototype disc-drum was designed and tested. In the second part of the report, the reduction of dynamic stresses which chain-driven face equipment undergo as a result both of longitudinal vibrations between the main and auxiliary drives and torsional vibrations in the wave train between the two electric motors of T-drives was investigated. (In German)

18015 **(EUR—8432-EN) Firedamp prediction and control (Report on ECSC contract 7220-AC/809).** (Commission of the European Communities, Luxembourg). 1983. 107p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

This report describes work carried out at MRDE in the related fields of methane content of coal seams and prediction of emission. Methods of measurement of the gas content of coal seams have been studied and data acquired relating to seams over a wide area. Computer programs have been written for data handling and retrieval. The MRDE prediction method has been tested at more sites, the underlying theory developed further and computer programs written to make the prediction calculations and comparisons. The dependence of emission on weekly face advance has been demonstrated, showing how in future it will be possible to update predictions frequently during the life of a district as weekly face advance changes.

18016 **(EUR—8433-EN) The use of chilled dust-suppression water and other techniques to control heat emission to the coalface (Report on ECSC contract 7220-AC/805).** (Commission of the European Communities, Luxembourg). 1983. 127p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

This report describes investigations into the use of chilled dust-suppression water to provide air cooling on coalfaces and the use of small-scale self-contained air coolers in regions where men are working out of the main airstream. It further describes investigations made on longwall districts into heat emission and pick-up with particular emphasis on electrical energy appearing as heat. The report also describes the use of the temperature prediction progam originally developed by StBV (Voss) in the particular case of inclined roadways where heat flows from air to strata.

18017 **(PB—84-132208) Selection of drilling fluids for minimizing coalbed damage. Final report, December 1981-February 1983.** Rose, R.E.; Foh, S.E.; Hayden, C.G.; Randolph, P.L. (Institute of Gas Technology, Chicago, IL (USA)). Nov 1983. 208p. (R—30553). NTIS, PC A10/MF A01.

The following conclusions have been drawn from work performed in this project: (1) both of the fluids tested (a KCl/CaCl2 brine and drilling mud filtrate) caused a loss in permeability when flowed through coal; (2) the damage mechanism for brine is undetermined, but the major part of the damage from mud filtrate appears to be related to particulate matter plugging flow channels; (3) a decrease in net confining pressure, caused by drilling overbalanced, can increase the risk of formation damage; and (4) an increase in net confining pressure, caused by drilling underbalanced, can also lead to permeability losses. The three potential formation damage mechanisms have been particulate plugging, clay swelling and/or migration, and relative permeability effects. Laboratory investigations have added a fourth - pressure effects.

18018 **(PB—84-137553) Surface evaluation of the 4m miniminer system. Report of investigations/1983.** Kwitowski, A. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Nov 1983. 79p. (BM-RI—8818). NTIS, PC A05/MF A01.

This report presents the results of a joint Bureau of Mines-U.S. Department of Energy project that evaluated a newly developed thin seam coal mining system: the 4M miniminer system. The evaluation took place from April through October 1981 and determined potential health, safety, and productivity factors for the mining system using the surface test facilities at Bruceton, PA. The planning, testing, results of testing, and a summary evaluation of the 4M miniminer system are included in the report.

18019 **(PB—84-138221) Cutting parameters affecting the ignition potential of conical bits. Report of investigations/1983.** Hanson, B.D. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). Nov 1983. 20p. (BM-RI—8820). NTIS, PC A02/MF A01.

The Bureau of Mines conducted a series of ignition tests with two types of conical bits (plumb bob and pencil) used on continuous mining machines, to determine their ignition potential at various bit speeds, cut depths, and wear conditions. The tests were conducted using single bits mounted on a 34-in-diam drum in a Bureau ignition test facility. The bits impacted blocks of Berea sandstone in a 6.5 pct methane atmosphere at various bit speeds and cut depths.

18020 **Methane recovery and utilization from coalbeds.** Wise, R.L. (Dept. of Energy, Morgantown, WV); Rightmire, C.T. *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* 1-11(Sep 1979).

Unconventional sources of natural gas already provide over 0.03 Tm^3 (1 Tcf) annually to the domestic gas production and could ultimately provide a much larger share of the natural gas supply. The Methane Recovery from Coalbeds Project has estimated the coalbed methane resource from 8.5 to 19.8 Tm^3 (300 to 700 Tcf). This paper presents project progress in resource verification, research and development, and technology systems tests. The resource verification activities involve major coal deposits throughout the U.S. The test projects feature various combinations of recovery and utilization systems including vertical and directional drilled boreholes, pipeline injection, mine power generation and space heating/boiler applications. 11 figures, 4 tables.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 17928

18021 **(ACIRL-PR—83-6) Suppression of dust during coal handling.** Membrey, W.B. (Australian Coal Industry Research Labs. Ltd., North Ryde). Aug 1983. 134p. Australian Coal Industry Research Labs. Ltd., North Ryde.

The report presents the findings of a study of the suppression of dust during coal handling. Scanning electron microscopy and electronic image analysis were used to determine the size distribution of coal samples. The wettability of dust size coal in a range of solvents was determined. The more important part of the program was the determination of the relationship between moisture content and dustiness of the coal. From a range of solvents tested it was found that water is the most effective suppressant. It was also concluded that a dust suppressant should aim to maintain the total moisture content of the coal. (17 refs.)

18022 **(ARL-TR—39) Beneficiation techniques applicable to Nova Scotia coals: literature review.** Moore, R.S. (National Research Council of Canada, Halifax, Nova Scotia). 1982. 59p. (NRCC—20462). National Research Council of Canada, Halifax, Nova Scotia.

The literature search concentrates on emerging physical techniques but includes possible promising chemical cleaning techniques. Techniques applicable to Nova Scotia coals that justify further consideration are identified. These include the Otisca process, high gradient magnetic separation, spherical agglomeration, column flotation, coal pyrite flotation, special and new equipment, advanced automation and refinement, and chemical processes. While the report contains no conclusions per se, the summary underlines trends in coal benefication collected from the literature and personal communications.

18023 **(ARL-TR—45) Improvement in aggregative flotation techniques.** Al Taweel, A.M.; Wojcik, J. (National Research Council of Canada, Halifax, Nova Scotia). 1983. 45p. (NRCC—22528). National Research Council of Canada, Halifax, Nova Scotia.

The effect of various parameters on the performance of the aggregative flotation process for beneficiatng fine coal was investigated. By optimizing the operational conditions for the DEVCO's Prince Mine coal it was possible to achieve recoveries with losses of the thermal value of less than 9%, while reducing the ash content by 64%. This was accomplished using 2 kg kerosine per ton coal which is lower than the usual requirements for spherical agglomeration of fine oxidized coals. It is believed that ash reductions have been somewhat restricted by the extent of liberation achieved at the grind tested. Sulphur reductions of only 18% were achieved through the addition of lime and the use of proprietry additives proved less successful. It is therefore suggested that biological surface modifications of the pyrite be tested to evaluate the possibility of simultaneously reducing sulphur levels. (30 refs.)

18024 **(DOE/PETC/TR—84/6) Flow loop studies with AMAX coal-water mixtures.** Wildman, D.J.; Ekmann, J.M. (USDOE Pittsburgh Energy Technology Center, PA). Mar 1984. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009209.

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The coal-water mixtures (CWM) with a stabilizer and the CWM without stabilizers were successfully transported through a flow loop facility under a variety of conditions. The handling characteristics of both CWM were reasonable. The mix tank mixer was not needed during nontesting hours to prevent settling of either material. After several days of transporting the nonstabilized material in the loop facility, the viscosity-reducing agent became ineffective. It was necessary to increase the concentration of the viscosity-reducing agent. The material with stabilizer could not be transported through the loop facility at mass flow rates greater than 209 lb/min until overnight shearing of the CWM in the tank. The CWM without a stabilizer appeared to be slightly shear-thickening, whereas the stabilized CWM initially exhibited shear-thinning behavior. The pressure losses measured for the nonstabilized material were similar to the pressure losses measured for CWM prepared at PETC with three or four percent higher concentration of Pittsburgh seam coal. Tests performed with the stabilized CWM experienced pressure losses similar to CWM prepared at PETC with Pittsburgh seam coal of five to seven percent higher concentration. Tests 1A, 2A, 1B, and 2B were not included in the comparison of in-house-prepared CWM due to differences in pretest handling procedures. 1 figure, 2 tables.

18025 **(EUR—8377-DE) New winning and transport methods for inclined faces hydraulic transport (Report on ECSC contract 7220-AD/111).** Maurer, H.; Benedum, W.; Mez, W.; Sold, W. (Commission of the European Communities, Luxembourg). 1983. 64p. (In German). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

The hydraulic transport of large-size solids in pipelines was investigated. Tests carried out included: the measurement of pressure loss, critical speed and slurry composition of run-of-mine coal/water mixtures; determination of size reduction of the coal and tailings; and developing measuring apparatus to determine the proportions of the components and the speed attained by the solids in a solids/water mixture. (In German)

18026 **(NP—4900859) Comparing the studies of a coal slurry pipeline. Special report No. 17.** Cox, C.B. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Virginia Water Resources Research Center). Dec 1983. 19p. NTIS, PC A02/MF A01. Order Number DE84900859.

The proposal to build a coal slurry pipeline in Virginia has become a hotly debated topics. In this report, a former Water Center staff member compares what eight separate studies have to say about its economic feasibility and its impact on employment and the environment. Only two of the studies examine the economic feasibility of a coal slurry pipeline, and both conclude that it would be feasible. Three reports indicate that a slurry pipeline would not hurt employment in Virginia. A fourth report concludes otherwise. Surface water was considered the most likely water source for the pipeline by reports considering the issue, but, emphasizes one report, impoundments may be necessary. The question of quality of the slurry water at the end of the pipeline is addressed. According to one report, the amount of degradation will be slight. Not so, says another, while a third concludes that contaminants would be removed by conventional water treatment methods. Using the slurry water to cool VEPCO's generators in Portsmouth is the choice method of disposal. Four reports examine the impact of pipeline construction on the environment and conclude that it could be serious, but two of the four believe that, with care, adverse effects could be greatly reduced or even eliminated. Based on the experiences of other pipelines, the likelihood of a rupture or spill is not great. One report describes a coal slurry pipeline as the least environmentally disruptive mode of coal transportation today.

0140 Combustion

REFER ALSO TO CITATION(S) 17925, 17972

18027 **(ARL-TR—33) Nozzles for burning CLM: 1. Abrasion of ceramic-modified Flo-Sonic nozzle, using a hot-spray test-loop.** (National Research Council of Canada, Halifax, Nova Scotia). 1982. 55p. (NRCC—19916). National Research Council of Canada, Halifax, Nova Scotia.

A hot-spray test-loop was constructed for circulating COW (55% coal) through atomizing nozzles. To avoid effects due to evaporative loss of water, the fuel was renewed after about fifteen cycles. Procedures and methods were developed in order to measure precisely the erosive wear of the COW on components of the nozzles. The erosive wear on a modified FloSonic nozzle, the critical parts of which were made of dense aluminium oxide, was small. The increase of the through put of the nozzle, due to wear, was only 0.2%/1000 gallons of fuel. The modified FloSonic nozzle is a good candidate for the combustion of CLM because of its atomizing ability and resistance to abrasion. (15 refs.)

18028 **(ARL-TR—34) Nozzles for burning CLM: 2. Abrasion of Peabody nozzle, using a hot-spray test-loop.** (National Research Council of Canada, Halifax, Nova Scotia). 1982. 37p. (NRCC—19917). National Research Council of Canada, Halifax, Nova Scotia.

The percentage enlargement of the critical orifices in the Peabody nozzle during the 200 hr. hot-spray test showed a remarkable similarity to that encountered during a demonstration burn at the Ontario Research Foundation and indicates that the hot-spray test is a valid method for evaluating the erosion effects of stabilized coal-oil-water (COW) composite fuels. The tested Peabody nozzle showed a tenfold greater susceptibility to erosive wear than the modified FloSonic burner tip tested in phase one. (5 refs.)

18029 **(ARL-TR—35) Nozzles for burning CLM: 3. Ten-hour burn of COW using ceramic-modified Flo-Sonic nozzle.** (National Research Council of Canada, Halifax, Nova Scotia). 1982. 45p. (NRCC—20453). National Research Council of Canada, Halifax, Nova Scotia.

This paper describes work carried out using the ceramic-modified Flo-Sonic nozzle to burn a coal/oil/water (COW) mixture in the flame tunnel of the Center for Energy Studies to demonstrate that the nozzle can burn COW, to identify areas for improvement, and to determine the effects of thermal shock on the ceramic parts of the nozzle.

18030 **(BMFT-FB-T—83-197) Development and testings of a low-nitrogen-oxide burner for p.f.-fired steam generators.** Rennert, K.D. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 114p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750493.

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Objective of the present investigation was to reduce the nitrogen oxide emission of p.f.-fired boilers by means of distributed

mixing of air and p.f. First tests were carried out with a prototype burner in two research stations (IFRF, IJmuiden and EER). Here the nitrogen oxide emission could be reduced by somewhat 60%. These first results were improved by the measurements taken in the power plant Weiher III (700 MW-unit). Here the staged mixing burner was retrofitted to an existing boiler. But nevertheless, the nitrogen oxide emission was reduced from 770 ppm to 350 ppm at MCR without increasing any other pollutants. It can therefore be stated, that by means of the Steinmueller staged mixing burner the nitrogen oxide emission of power plants can be reduced by 50-60% without any disadvantage for boiler operation.

18031 **(CONF-830483—3) Performance and economic analysis of gas turbine power plants fueled with a coal-water mixture.** Bajura, R.A.; Berkshire, L.H.; Hand, T.J.; Morel, W.C.; Notestein, J.E. (USDOE Morgantown Energy Technology Center, WV). 1983. 23p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009321.

From 5. international symposium on coal slurry combustion and technology; Tampa, FL, USA (25 Apr 1983).

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Thermal performance calculations and economic scoping studies have been made for gas turbine power generation systems which are fueled by coal-water mixtures. The feasibility of using coal-water mixtures for the direct firing of open cycle gas turbines is being evaluated by the Department of Energy as part of the coal-fueled gas turbine program. This program addresses the perceived need for low cost, short lead time power generating systems which are capable of burning coal in an environmentally acceptable manner. The fuel used for this study was a slurry of water and highly cleaned, extremely fine coal particles. It was assumed that this prepared liquid fuel, an ultraclean coal water mixture (UCCWM), would be delivered to a gas turbine facility thereby eliminating the need for on-site coal cleaning and grinding equipment. The evaluation also assumed that high combustion efficiencies could be achieved in an UCCWM-fired gas turbine and that erosion, corrosion, or deposition would neither cause significant reduction in turbine performance nor markedly reduce turbine operating life. Under these assumptions, performance calculations showed that gas turbines fueled with UCCWM have similar thermal efficiencies to those fueled by distillate oil. The economic incentives for UCCWM gas turbine combined-cycle plants were derived by calculating the maximum allowable UCCWM fuel price which would give the same cost of electricity as that of conventional fossil fueled power plant alternatives. The largest economic incentive was found in a scenario requiring base load generating capacity in a relatively short 4-year lead time. This scenario showed that a 500-MW UCCWM power plant would be competitive with a 500-MW oil-fired plant as long as the cost of the delivered UCCWM was less than $\$6.83/10^6$ Btu. 10 references, 5 figures, 7 tables.

18032 **(CONF-831112—4) Application of advanced coal technology for refinery process heater design.** Levy, B.L.; Doescher, R.G. (Stone and Webster Engineering Corp., Boston, MA (USA)). 1983. 21p. Stone and Webster Engineering Corp., Boston, MA.

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

Many studies have been performed to consider the feasibility of burning coal or other solid fuels in refinery equipment to increase the yield of product from a given feedstock. A modern, energy efficient refinery consumes energy equivalent to approximately 8% of its feedstock. Approximately 31% of the energy consumed is for steam generation. Most past study has evaluated replacement of this energy use with a coal or solid fuel. Another large energy consumer is process fired heaters, including atmospheric and vacuum crude heaters. These heaters, representing the very heart of the refining process, are usually fired with natural gas, No. 6 oil or waste gas and can consume up to 34% of energy use. Any of these fuels could be better used to increase refinery yield or exported from the refinery as a salable product. Due to the sensitivity of the refining process and the requirement for accurate control of heat input, however, these heaters have rarely been considered as possible users of coal or other solid fuels. This paper examines the technical and economic feasibility of applying a developing coal technology, two stage slagging combustion, to both the retrofit of existing crude heater and installation of new replacement units. This technology will allow combustion of coal or slurry fuels with little modification to existing heater design. As a result the conversion cost for an existing unit, and the incremental costs for providing coal capability on a new unit, are in a range where moderate paybacks can be expected. As larger units are considered, or higher petroleum prices are forecast the economics of this technology become increasingly more attractive.

18033 **(DOE/FE/60181—29) Effect of coal particle size on fouling potential of a high sodium North Dakota lignite coal.** Jones, M.L.; Miller, B.G. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Feb 1984. Contract FC21-83FE60181. 17p. (CONF-840262—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007411.

From International conference on deposits and corrosion in industrial and utility combustion systems; Essen, F.R. Germany (29 Feb 1984).

An area of interest for almost twenty years has been ash fouling in low-rank coal combustion systems. Studies over the years have involved monitoring of full-scale combustion facilities, work on pilot scale pc-fired combustion units, and laboratory work to characterize ash fouling deposits and examine mineral matter transformation. Micronized coal has been discussed as an alternate fuel for utility and industrial size boilers. Previous work has shown that micronized bituminous coal has potential as an alternate fuel in boilers designed for oil or gas. Test results indicated decreased deposition rates, and increased sintered strength of fly ash produced during combustion. In addition, others have shown that lignites even with high moisture content can be micropulverized and therefore considered for firing in this form. This paper describes recent work at UNDERC to examine the effect of coal particle size on ash fouling when burning a high fouling North Dakota lignite. Differences were noted in the rate of deposition, strength of deposits, and composition of deposits produced from a standard utility grind and a much finer (micronized) grind. 7 references, 5 figures, 5 tables.

18034 **(DOE/PC/30185—T3) Development and evaluation of coal/water mixture combustion technology. Final report.** Scheffee, R.S.; Rossmeissl, N.P.; Skolnik, E.G.; McHale, E.T. (Atlantic Research Corp., Alexandria, VA (USA)). Aug 1981. Contract AC22-80PC30185. 179p. NTIS, PC A09/MF A01. Order Number DE84002140.

The objective was to advance the technology for the preparation, storage, handling and combustion of highly-loaded coal/water mixtures. A systematic program to prepare and experimentally evaluate coal/water mixtures was conducted to develop mixtures which (1) burn efficiently using combustion chambers and burners designed for oil, (2) can be provided at a cost less than that of No. 6 oil, and (3) can be easily transported and stored. The program consisted of three principal tasks. The first was a literature survey relevant to coal/water mixture technology. The second involved slurry preparation and evaluation of rheological and stability properties, and processing techniques. The third consisted of combustion tests to characterize equipment and slurry parameters. The first task comprised a complete search of the literature, results of which are tabulated in Appendix A. Task 2 was involved with the evaluation of composition and process variables on slurry rheology and stability. Three bituminous coals, representing a range of values of volatile content, ash content, and hardness were used in the slurries. Task 3 was concerned with the combustion behavior of coal/water slurry. The studies involved first upgrading of an experimental furnace facility, which was used to burn slurry fuels, with emphasis on studying the effect on combustion of slurry properties such as viscosity and particle size, and the effect of equipment parameters such as secondary air preheat and atomization.

18035 **(DOE/PC/30301—11) CaO interaction in the staged combustion of coal.** Levy, A.; Merryman, E.L.; Rising, B.W. (Battelle Columbus Labs., OH (USA)). 19 Dec 1983. Contract AC22-80PC30301. 138p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84007869.

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The LIMB (limestone injection multi-stage burner) process offers special potential for reducing NO/sub x/ and SO/sub x/ by at least 50 percent in coal combustion. This is to be accomplished by adding limestone with fuel and/or air in a low NO/sub x/ burner. This program has been directed to defining the chemistry and kinetics necessary to optimize sulfur capture in LIMB combustion. More specifically, this program has attempted to clarify the role of calcium sulfide in LIMB chemistry. When limestone is added in a staged burner, there is a strong possibility that under certain circumstances CaS is produced in the reducing (fuel-rich) zone of the burner. Since CaS is more stable than $CaSO_4$, this affords the opportunity to (1) operate the burner at a higher temperature, 2200 to 2500 F, (2) pass the CaS rapidly through the high temperature zone (before dissociation), and (3) complete the combustion in a lean (air-rich) region where the sulfur is finally retained in $CaSO_4$. For these reasons this program has concentrated on the high temperature chemistry and kinetics of CaS. To achieve the program objective, the program was divided into three tasks. These involved (1) a study of CaS formation, (2) a brief examination of CaS oxidation, and (3) a laboratory examination of the combustion of coal in the presence of CaO under first stage, fuel-rich conditions. In the most general sense, the study has shown that the formation of CaS in the reducing zones of the burner may be restricted by competing kinetics and thermodynamics. The addition of lime in LIMB will require special care to optimize the ability to capture sulfur. 36 references, 44 figures, 10 tables.

18036 **Advanced fluidized bed technology applied to coals and other fuels.** Litt, R.D. (Battelle Columbus Lab., OH); Sirois, R.H. pp 1-11 of Advanced fluidized bed technology applied to coals and other fuels. Litt, R.D.; Sirois, R.H. (eds.). Lexington, KY; Univ. of Kentucky (1983). (CONF-8304138—).

From 22. annual Kentucky industrial coal conference; Lexington, KY, USA (13 Apr 1983).

Multisolid Fluidized Bed Combustion (MSFBC) is an advanced circulating fluidized bed technology, which can utilize our nationally abundant fuels with proven operation and economy. The steam generator system coupled to the MSFBC provides operating efficiency, mechanical reliability and flexibility for a myriad of plant siting contraints. A comparison of this technology with conventional, first generation, fluidized bed combustion systems is provided. Results are presented on a variety of fuels to demonstrate system capabilities to control NO/sub x/ and SO_2 emissions to meet stringent conditions, without sacrificing operating experience are also described in this paper. 3 references, 9 figures, 4 tables.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 17989, 18402, 18650

18037 **(CONF-830483—4) Coal and petroleum coke mixtures: regional US markets and competitive pricing (1985-2000).** (Hagler, Bailly and Co., Washington, DC (USA)). Apr 1983. 33p. NTIS, PC A03; 3; GPO Dep. Order Number DE84009322.

From 5. international symposium on coal slurry combustion and technology; Tampa, FL, USA (25 Apr 1983).

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This study constitutes a comprehensive analysis of the regional US market for slurries of coal and petroleum coke in various liquids. The results of the analysis are presented by: type of mixture, geographical region (state), market segment, time period, and mixture blending plant size. Four aspects of our study are: The study is up to date; to reflect the great uncertainty surrounding future energy prices, technology cost, and performance and regulations, our analysis is based on three scenarios (unfavorable, base case, and favorable); we have analyzed the industrial market in great detail, examining both boilers and direct heat applications down to the type of equipment used. (We have also considered the emergency of new and replacement markets in addition to the traditional retrofit market); and we have analyzed the competition of coal mixtures, not only with residual oil, but with all alternative fuels, including other mixture types, straight coal, and natural gas. The detailed report on the study is available for US $9500. The report comprises two volumes: Volume 1 (212 pages) presents the results, and Volume 2 (424 pages) presents the supporting data and assumptions. A free review of the study findings is available to each subscriber.

18038 **(TVA/PUB—84/22) Acid rain legislation: its impact on electric utilities.** High, M.D. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). 1984. 22p. NTIS, PC A02. Order Number DE84900912.

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The costs of impending legislation controlling power plant emissions to TVA utilities and their ratepayers are presented. Two approaches have been proposed for achieving SO_2 emission reductions. One would require the utilities to rely heavily on scrubbers; the second would give the utilities the flexibility to select the least cost method for reducing emissions. Using scrubbers, the average cost of SO_2 reduction would be $640 per ton removed. Using least-cost method, the cost would be $200.00 to $400.00 per ton removed. Scrubbers are the lower cost option at newer, more efficient plants which operate at base load and are located in areas where low-sulfur coal is not readily available. Low-sulfur coal is more economical for older plants which operate in an intermediate or peaking mode. If emission reductions of 8 million tons of SO_2 or less from coal-fired power plants are required, savings up to about $800 million per year would be achieved using a least-cost strategy. For emission reductions greater than 8 million tons, the saving decreases. At about 11 million tons, the costs are the same. 16 figures. (DMC)

0160 Health And Safety

REFER ALSO TO CITATION(S) 18019

18039 **(BMFT-FB-HA—83-018) Improvement of lighting equipment on miners working places.** Menne, P.; Sorge, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 170p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750495.

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Mechanization and partial automation of the production processes in mining increases the stress caused by perceptive performance. Ergonomical and lighting-technological bases were lacking in the field of underground lighting. The investigations were made in view of - development and testing of measuring equipment, methods, and regulations conforming to conditions in mining, for establishing lighting criteria; - drafting of minimum reference requirements with respect to lighting, based on kind of activity, place of activity, and optical perceptibility data of staff; - development and experimental operation of suited lighting systems for meeting said reference values. Based on available or adapted methods, ergonomical, lighting-technological, and electro-technological investigations were carried out. Suited - measuring equipment, methods and regulations; - lighting criteria for activities and places specified underground and - an "intrinsically-safe" lighting system were developed. The lighting minimum values will become compulsory. Measuring equipment, methods and regulations will be standardized and are also applicable in other industries e.g. in all areas of explosion proving. The lighting prototypes developed will undergo life tests in the field.

18040 **(DOE/NBB—0008) Status of health and environmental research relative to solid wastes from coal conversion.** Francis, C.W.; Wobber, F.J. (comps.). (Battelle Pacific Northwest Labs., Richland, WA (USA); Los Alamos National Lab., NM (USA); Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.; Oak Ridge National Lab., TN (USA)). Jan 1982. Contract W-7405-ENG-26. 121p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84007668.

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The purpose of this document is to evaluate the status and make recommendations about the future needs of health and environmental research relative to solid wastes from coal conversion processes. The objectives are to evaluate the health and environmental implications resulting from solid wastes generated on implementation of a commercial coal synfuel technology and identify research that will elucidate long-term effects of their disposal on human health and environment. The quantity of solid wastes generated at each commercial-sized facility will constitute a major waste management problem. Solid wastes from coal conversion processes contain toxic heavy metals as well as mutagenic and carcinogenic organic compounds. However, the major problem associated with disposal of these solid wastes is not the acute toxicity or carcinogenicity of the wastes, but rather the generation of solid waste leachates from the large volume wastes, predominantly coal preparation wastes and gasifier ashes and slags. Leachates from these waste forms are not highly toxic but tend to become acidic with age and contain sufficient concentrations of toxic contaminants such as Cu, Zn, Pb, Cd, B, Ni and others that long-term releases will overtax natural attenuation or dispersal mechanisms. Solid waste management practices to be implemented at coal conversion facilities will have to comply with recent regulations under the Resource Conservation and Recovery Act (RCRA). One of the goals in this document is to identify research needs that will provide for the development of safe and economic disposal methodologies for solid wastes from coal conversion processes. To aid in the identification of these needs, the available data base on health and environmental research relative to coal conversion wastes was reviewed. 132 references, 4 figures, 29 tables.

02 PETROLEUM

0201 Reserves

REFER ALSO TO CITATION(S) 18064

18041 **(USGS-OFR—83-728) Distribution and quantitative assessment of world crude-oil reserves and resources.** Masters, C.D.; Root, D.H.; Dietzman, W.D. (Geological Survey, Reston, VA (USA); USDOE Energy Information Administration, Dallas, TX. Dallas Field Office). 1984. 23p. US Geological Survey-Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

World Demonstrated Reserves of crude oil are approximately 723 billion barrels of oil (BBO). Cumulative production is 445 BBO and annual production is 20 BBO. Demonstrated Reserves of crude oil have declined over the past 10 years consistent with discoveries lagging production over the same period. The assessment of Undiscovered Resources shows a 90% probability that the amount discoverable lies between 321 and 1417 BBO, 550 BBO being the most likely value. The most likely value for Ultimate recoverable resources is 1718 BBO. The distribution of Ultimate Resources of crude oil will remain highly skewed toward the Middle East; no frontier areas that have potentials large enough to significantly affect present distribution are recognized. Rates of discovery have continued to decline over the past 20 years even though exploration activity has increased in recent years. Prudence dictates, therefore, that the low side of the assessment of Undiscovered Resources be responsibly considered and that alternate energy sources be a part of future planning. Extra-heavy oil and bitumen are assessed separately, with Reserves being figured as the annual productive capacity of installed facilities times 25 years. The annual production of extra-heavy oil is about 8 million barrels and of bitumen about 60 million barrels.

0202 Geology And Exploration

18042 **(NP—4900448) Oil and gas exploration in Washington, 1900-1982.** McFarland, C.R. (Washington Div. of Geology and Earth Resources, Olympia (USA)). 1983. 126p. Dept. Of Natural Resources, Olympia, Washington $2.50.

This compilation of oil and gas test wells in Washington is a revision and update of Information Circular 67R (McFarland, 1981). Much of the information used in this report was taken from the Division of Geology and Earth Resources oil and gas files. The history of oil and gas exploration are reviewed, and prospects for oil and gas production are presented. The tabulation of oil and gas test wells is arranged in alphabetical order, according to counties. Under the county heading, the wells are listed chronologically in order of the date spudded and, with some exceptions, in the order of the state drilling permit number. Permit numbers and American Petroleum Institute unique numbers are assigned to wells when application to drill is filed with the Division of Geology and Earth Resources. Unique numbers are part of the American Petroleum Institute's nationwide system for identifying all oil and gas wells in the country.

18043 **(USGS-OFR—82-411) Oil, gas, and helium references index for the Navajo Indian Reservation, Arizona, New Mexico, and Utah.** Bliss, J.D. (Geological Survey, Menlo Park, CA (USA)). Feb 1982. 25p. USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

The references which are listed in this document represent the readily available literature about oil, gas, and helium resources on or adjacent to the Navajo Indian Reservation. They were selected during the developmental phase of the Navajo Resource Information System (NRIS). The system contains a set of computerized data bases addressing various resource categories. The system was developed by the US Geological Survey in coordination with the Minerals Department, Navajo Nation. Literature is the foundation of resource assessment and the absence of such a compilation for the Navajo Nation prompted the development of a reference data base entitled nref, which consists of over 1300 records. The following reference list of approximately 230 references was selected from those citations which contain oil, gas, or helium in a keyword list attached to each citation. References to general literature on oil, gas, or helium may also be present. The main attempt was to list most of the literature published in the 1960's and 1970's for areas in, or adjacent to, the Navajo Reservation. References published prior to this were included only if readily available or if they seemed to represent areas or topics not covered in later publications. 223 references.

18044 **New pressure transient analysis methods for naturally fractured reservoirs.** Serra, K.; Raghavan, R.; Reynolds, A.C. (Univ. of Tulsa). *Journal of Petroleum Technology;* **35**: No. 10, 1902-1914(Oct 1983). Contract AC21-80MC14645.

This paper presents new methods for analyzing pressure drawdown and buildup data obtained at wells producing naturally fractured reservoirs. The model used in this study assumes unsteady-state fluid transfer from the matrix system to the fracture system. A new flow regime is identified. The discovery of this flow regime explains field behavior that has been considered unusual. The probability of obtaining data reflecting this flow regime in a field test is higher than that of obtaining the classical responses given in the literature. The identification of this new flow regime provides methods for preparing a complete analysis of pressure data obtained from naturally fractured reservoirs. Applications to field data are discussed.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 18050

18045 **(DOE/BC/10412—44) SORCES - a statistically oriented reservoir comparison and evaluation system. Multivariate interrelationships in heterogeneous reservoir systems for EOR prediction and assessment. Phase 1. The concept, proposed methodology, and pilot-scale testing.** Appan, S.G.; Gumnick, J.L.; Lohse, S.A.; Shields, J. (GURC, Bellaire, TX (USA)). Feb 1984. Contract AS19-81BC10412. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84007939.

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The objectives of this research are: (1) develop capabilities to describe reservoir heterogeneity patterns in sufficient detail to

model and predict their effects on enhanced oil recovery EOR; (2) improve EOR theory and performance predictability using the steadily accumulating body of knowledge from completed and ongoing field tests; and (3) investigate additional modeling techniques, especially multivariate, probabilistic statistical approaches, to support deterministic prediction methods. The proposed approach is to use multivariate statistical analysis techniques to develop two descriptive/predictive models. The first, a Geosystem Types Model, would quantitatively address reservoir heterogeneity, and the second, an EOR Performance Probability Path Model, would quantitatively address EOR performance using reservoir descriptive and process design data. A principal emphasis in both these models is that the resulting predictions will be probabilistic rather than deterministic and will be based on statistical treatment of empirical observations. These two models are being developed under a unified concept which GURC calls SORCES - a Statistically Oriented Reservoir Comparison and Evaluation System. The product goal is a computer-interactive decision support system, patterned after the emerging expert system concept. The research design of this project is segmented into three consecutive implementation phases. This report presents the results of Phase 1 of SORCES. The objectives of Phase 1 are as follows: (1) concept development of the two models; (2) development of multivariate statistical methodologies to be used for generating the two models; and (3) pilot-scale testing and evaluation of such methodologies. The results of Phase 1 test was promising. 30 references, 17 figures, 9 tables.

18046 **(DOE/BETC/QPR—83/3) Liquid fossil fuel technology.** (USDOE Bartlesville Energy Technology Center, OK). 1983. 63p. NTIS, PC A04/MF A01. Order Number DE84009081.

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Progress reports are presented under the following headings: (1) extraction (technology assessment, oil research, gas research); (2) liquid processing (characterization, thermodynamics, processing technology); (3) utilization (energy conservation); and (4) project integration and technology transfer. BETC publications are also listed. Some of the highlights for this period are: the Bartlesville Energy Technology Center was converted into NIPER, the National Institute for Petroleum and Energy Research on October 1, 1983; modelling of enthalpies, heat capacities and volumes of aqueous surfactant solutions began using a mass action model; a series of experiments were run on upgrading by hydrogenation SRC-II coal liquid at different degrees of severity and the products have been analyzed; heavy crude oil extracts were separated into fraction with high performance liquid chromatography by Lawrence Berkeley Laboratory and the mass spectra and electron spin resonance were determin ed; and particulates from exhaust gases of diesel engines using fire fuel types are being collected and will be analyzed by chemical methods and results will be compared with those obtained by biological assay. (ATT)

18047 **(DOE/SF/11445—2) Field experiment of steam drive with in-situ foaming. Report for the period October 1, 1980-September 30, 1982.** Brigham, W.E.; Malito, O.P.; Sanyal, S.K. (Stanford Univ., CA (USA). Petroleum Research Inst.). Feb 1984. Contract AC03-80SF11445. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84007796.

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This report discusses the design and execution of a field experiment on recovery of heavy oil by steam drive with in-situ foaming by Suntech IV in the Kern River oil field, California. The project background, goals, and field work completed to date are reviewed. Several standard and experimental analytical methods have been applied to define the reservoir and to monitor the progress of the field experiment. The analysis of the results to date indicate that Suntech IV surfactant shows considerable promise in improving heavy oil recovery by steam drive with in-situ foaming. 21 references, 72 figures, 12 tables.

18048 **(LBL—17221) Some recent progress in steep front calculations for porous flow.** Concus, P.; Kostlan, E.; Sethian, J.A. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 17p. (CONF-831256—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008249.

From 6. international conference on computing methods in applied sciences and engineering; Paris, France (12 Dec 1983).

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A modification to the random choice method is investigated for solving the equations for multidimensional immiscible displacement in a porous medium. The principal feature of the modification is to represent multidimensional flow correctly by incorporating local properties of the flow into the one-dimensional Riemann solvers of the split random choice method. Advancing fronts are kept accurate and sharp. We perform a numerical experiment using the method to study the stabilizing effect of a small amount of physical capillary pressure on a case for which the advancing front is unstable. 12 references, 14 figures.

18049 **(SAND—83-0756) Examination of frontal development during a dry forward combustion.** Lee, D.O.; Wayland, J.R. Jr.; Montoya, P.C. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008304.

The thermocouple data from the various locations of the combustion tube for a dry forward burn were examined. Based on these data the behavior of the burn front was reconstructed and interpreted to obtain such frontal parameters as burn front velocity, its thickness, the component zone velocities, and the thicknesses of the component zones of the front as a function of time and distance in the tube. These component zones of the front are then indicated by the capacitance and resistivity measurements obtained by instrumentation developed for this purpose. Thermogravimetric analysis was also used to further quantify the specific events.

0204 Processing

REFER ALSO TO CITATION(S) 18032, 18046

0205 Products And By-products

REFER ALSO TO CITATION(S) 18037

0206 Health And Safety

18050 **(PB—84-132687) Safety and health in the construction of fixed offshore installations in the petroleum industry.** (International Labour Organization, Geneva (Switzerland)). 1981. 143p. NTIS, PC $11.40.

A meeting convened by the ILO (International Labor Office) on safety problems in the offshore petroleum industry recommended the preparation of a code of practice setting out standards for safety and health during the construction of fixed offshore installations. Such a code, to be prepared by the ILO in co-operation with other bodies, including the Inter-Governmental Maritime Consultative Organisation (IMCO), was to take into consideration existing standards applicable to offshore construction activities and to supplement the ILO codes of practice on safety and health in building and civil engineering work, shipbuilding and ship repairing. (Copyright (c) International Labour Organisation 1981.)

0207 Marketing And Economics

18051 **(DOE/EIA—0380(83/12[3])) Petroleum Marketing Monthly.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Mar 1984. 113p. NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. Order Number DE84008263.

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Information and statistical data about a variety of petroleum products, including motor gasoline, distillates, residuals, jet fuel, kerosene, and propane are given. The publication provides petroleum products sales statistics for use by industry, government, and private sector analysts, educational institutions, and consumers.

18052 **(DOE/IE—0002) Strategic Petroleum Reserve distribution readiness exercise (DIREX-B).** (USDOE Assistant Secretary for International Affairs and Energy Emergencies, Washington, DC). Feb 1984. 251p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84008167.

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During July and August of 1983, the Department of Energy conducted a test of its ability to draw down the Strategic Petroleum Reserve (SPR) in the event of an energy disruption. That test, designated SPR Distribution Readiness Exercise, Phase B (DIREX-B), was one in a series of ongoing tests of the SPR system. The DIREX-B exercise either tested or simulated drawdown procedures related to management and decisionmaking processes, as well as those involving SPR crude oil sales and operations. The SPR is a vital component of the nation's emergency preparedness program, and maintaining ready and responsive SPR drawdown procedures is a critical and continuing goal. For that reason, the Department established an independent Assessment Team to monitor and appraise the effectiveness of the DIREX-B exercise. The team was tasked with responsibility for providing an independent evaluation of the utility and efficiency of existing plans and procedures governing drawdown decisionmaking, bid solicitations, crude oil sales and deliveries, and related administrative actions.

18053 **(DOE/PE/70455—T1) Macroeconomic consequences of oil price and tax policies. Final report.** Goettle, R.J. IV; Hudson, E.A. (Jorgenson (Dale W.) Associates, Cambridge, MA (USA)). 30 Dec 1982. Contract AC01-82PE70455. 192p. NTIS, PC A09; 3; GPO Dep. Order Number DE84007700.

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This analysis examines the macroeconomic consequences of selected federal energy policies affecting petroleum prices and the disposition of oil market revenues. Specifically, it compares overall economic performance under current oil policy conditions, which include full price decontrol in 1981 and the imposition of a windfall profits tax on domestic production, to that arising under alternative policy situations. These cover the continuation of oil price controls, elimination of the windfall profits tax (under various government financing schemes), and substitution of a reformed windfall profits tax beginning in 1983. Also, each policy is analyzed under two sets of conditions defining future world oil prices.

18054 **(NP—4900858) Market shares and individual company data for US energy markets, 1950-1982.** Brannan, M.A.; Piccini, R.A. (American Petroleum Inst., Washington, DC). Nov 1983. 167p. American Petroleum Inst., 1220 L Street, Northwest, Washington, DC 20005.

1982 data is presented on concentration in various US energy markets, and it also provides revised data for previous years where available. The report is intended to be a handy compilation of statistics on concentration in US energy markets with particular emphasis on the petroleum industry. The report contains four parts. First, it summarizes trends in concentration. This summary includes tables giving concentration indexes for the various energy markets for 1982 and several earlier years. Secondly, it discusses methodology and definitions. Thirdly, the report provides annual company-by-company data on market shares in various segments of the petroleum industry. Finally, the report presents similar market share data for coal, uranium, and for all-energy combined. The tables in the report's third and fourth sections provide sources and qualifications as necessary.

18055 **(UT/CES-PS—23) Evidence on joint venture formation for offshore oil lease sales.** Gilley, O.W.; Karels, G.V.; Lyon, R.M. (Texas Univ., Austin (USA). Center for Energy Studies). Nov 1983. 40p. NTIS, PC A03/MF A01. Order Number DE84900919.

Alternative explanations of joint bidding for offshore oil track leases are examined. The models suggest that firms undertake joint bids: (1) to reduce risk by spreading ownership across tracks; (2) to share technical expertise including information; and (3) to ameliorate financial restraints. These hypotheses are examined empirically using the multiple logit technique and other tests with data constructed from the Baltimore Canyon sale of 1976. The results suggests that firms' behaviors are consistent with the explanations of diversification and sharing of expertise; explanations based on financial constraints are shown to be consistent with the data in the risk-averse case but not in the risk-neutral case. Implications of these results for research and policy are discussed. 31 references, 1 table.

18056 **Oil prices, energy security, and import policy.** Bohi, D.R.; Montgomery, W.D. Washington, DC; Resources for the Future, Inc. (1982). 215p. (DOE/NBM—4004242). Resources for the Future Inc., 1755 Massachusetts Ave., N.W., Washington, DC.

This study separates arguments for government intervention, evaluates their determinants, shows how they are interrelated, and how to choose a selection process for intervention. The study is conceptual rather than empirical and is developed from conventional tenets of the theory of the firm and consumer choice with qualitative conclusions drawn about energy policy. Policy problems here deal primarily with international trade in oil. (PSB)

0208 Waste Management

18057 **(DOE/CS/40338—4) North Carolina used motor oil - refining program. Final report.** Griffith, W.C. (North Carolina State Univ., Raleigh (USA). Dept. of Mechanical Engineering). Feb 1984. Contract FG01-80CS40338. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009104.

Experience of the State of North Carolina in acquiring and demonstrating a new type of plant for re-refining used motor oil is documented in a series of publications and summarized in this final report. The recycling program included development of a complete system for collecting used oil, re-refining and drumming operations, and product sales to State and local government agencies. The program was undertaken as a part of the State's overall energy and resource conservation plan. Specifically, the goals were to demonstrate oil re-refining, save energy and a valuable, limited natural resource and by so doing increase public awareness of conservation. Feasibility studies initiated in 1976 suggested that re-refining used motor oil for State and local government vehicle fleets would be technically and economically attractive for a rate of about 500,000 gallons of oil per year using a new process developed by the Phillips Petroleum Company. Executive and Legislative approval was given to purchase a turnkey plant for $1.4 million. After the first year of operation, a number of changes to procedures and the plant itself were identified as necessary for reaching the desired production rate. Concurrently, the dramatic shifts in world oil prices and availability contributed to a shortage of used motor oil suitable for re-refining. This shortage continued through mid-1983, seriously limiting demonstration of plant performance as modified. The following results of operations for the first two and a half years have been obtained: product quality consistently excellent; cummulative sales approaching 500,000 gallons; average cost of product between $4 to $5 per gallon compared to sales price of $2.57 per gallon; current projections indicate economic break-even at 500,000 to 600,000 gallons per year rate; environmental impact of re-refining generally benign, singular events containable; and future operations viable, marginally attractive for private investments. 8 figures.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 19122

18058 **(AD-A—135621/1) Binomial acceptance sampling plans for evaluating oil-water separator performance. Technical report.** Burns, K.C. (Desmatics, Inc., State College, PA (USA)). Nov 1983. 20p. (TR—106-13). NTIS, PC A02/MF A01.

There are several oil-water separator systems currently being developed for possible future use aboard Navy ships, In order to be accepted, these systems must meet certain specified requirements: In Port -- 20 ppm of oil or less in effluent water at least 95% of the time; and At Sea -- 100 ppm of oil or less in effluent water at least 99% of the time. In order to determine whether a system meets the threshold requirements given above, a binomial acceptance sampling plan is often used. In this type of plan, a specified number of effluent samples are collected and analyzed. Each sample is then classified as either a success (oil content does not exceed threshold) or a failure (oil content exceeds threshold). If the number of failures is not greater than some prespecified number, c, the system is accepted. If the number of failures exceeds c the system is rejected.

18059 **(PB—84-122597) Simulation of spilled oil behavior in bays and coastal waters.** Hess, K.W. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Techniques Development Lab.). Oct 1983. 29p. NTIS, PC A03/MF A01.

OILSPILL is a computer program designed to forecast the behavior of floating oil in the coastal zone. The program, written in FORTRAN IV, runs on the AFOS (Automation of Field Operations and Services) Data General Eclipse S/230 computer. It can be stored on floppy disk and retrieved when it is to be run. The program, which is run at the Alphanumeric Disply Module (ADM), requires input such as oil spill location, map parameters, and wind and water current forecasts.

18060 **(PB—84-132711) Characteristics of petroleum and its behaviour at sea.** van Oudenhoven, J.A.C.M.; Draper, V.; Ebbon, G.P.; Holmes, P.D.; Nooyen, J.L. (Concawe, The Hague (Netherlands)). 1984. 56p. (CONCAWE—8/83). NTIS, PC E04/MF E01.

The report examines the various interrelated factors which can affect the behaviour of spilt oil in a marine environment and, consequently, influence the effectiveness of oil spill clean-up methods. These factors relate not only to the origin and nature of the oil itself, but also to such processes as spreading, evaporation, dispersion, emulsification, dissolution, sedimentation and degradation. The report first discusses the way in which each separate process will affect the rate of weathering of the spilt material, and uses mathematical models to estimate the corresponding changes in physicochemical properties. A further chapter considers how these processes interact and influence the ultimate fate of the spilt material and options for its treatment and/or collection. The report classifies different crude oils into groups which will behave in a similar way after spillage at sea and will therefore require similar treatment methods. A detailed compendium giving relevant properties of some 57 crude oils is included as an appendix. (Copyright (c) CONCAWE Den Haag November 1983.)

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 18053

18061 **(WAOENG—83-12) Washington State Petroleum Products Contingency Plan.** (Washington State Energy Office, Olympia (USA). Resource Development and Energy Management Div.). Sep 1983. 268p. Washington State Energy Office, 400 E Union, Olympia, Washington 98504.

The Washington State Petroleum Products Contingency Plan has been designed to provide the parties who may be affected by a petroleum shortage, as well as public and private decision makers, with a framework of meaningful options for dealing with various petroleum shortfall scenarios. The current edition of the plan represents an effort to address a radical change in federal policy with regard to petroleum shortage contingency planning. That change in federal policy is reflected in the removal of regulatory controls on the pricing and distribution (allocation) of crude oil and refined petroleum products. The current plan consists of two basic options. The first option (Plan Option A) is essentially the original plan and is intended for responding to petroleum shortages when federal price and allocation controls are in effect. The second option is new and is intended for responding to shortages in the absence of federal price and allocation controls. Section II of this document provides an introduction to the plan. Section III contains provisions which are applicable to both Plan Option A and Plan Option B. These provisions include definitions, commonly used abbreviations, planning principles, authorities, organizational responsibilities, priority end-use classifications, decision-making process, communications system, and other general purpose provisions. Section IV contains Plan Option A, which provides a trigger mechanism and a four-stage structure for responding to petroleum shortages under federal price and allocation controls. Section V contains Plan Option B, which provides a trigger mechanism and a two-stage structure for responding to petroleum shortages in the absence of federal price and allocation controls. Section VI contains an identification, categorization, and descriptions of suggested contingency measures for use under Plan Option A and Plan Option B. Also provided are criteria for evaluating and selecting contingency measures.

0230 Properties

REFER ALSO TO CITATION(S) 18046

0240 Storage

REFER ALSO TO CITATION(S) 18052, 19224

18062 **(DOE/FE—0036) Strategic Petroleum Reserve. Annual report.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Strategic Petroleum Reserve). 16 Feb 1984. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007802.

This report covers Strategic Petroleum Reserves (SPR) developmental activities during the 1983 calendar year. It is presented in three sections along with an Appendix. The introductory section briefly covers the legislative basis for the SPR Program and the SPR Plan and Amendments. The current status of the SPR and the appropriations to date are outlined in Section II. The drawdown system and vulnerability impact are set forth in Section III. The Appendix contains detailed information on the status of the each SPR site. Some of the highlights are: SPR achieved a fill level of 379.1 million barrels during 1983, more than half the program fill goal of 750 million barrels; crude oil deliveries under the 1982 purchase agreement with Mexico were completed; development of Phase II underground storage capacity expansion, consisting of 290 million barrels, continued on schedule at three SPR sites; futher progress of Phase III development, which will consist of approximately 200 million barrels, was achieved during 1983; successful drawdown tests were conducted at the Bayou Choctaw and Bryan Mound sites; based on drawdown tests, current inventory levels and other information, the Department estimates that 189 million barrels of the 379.1-million-barrel-inventory on December 31, 1983, could be drawn down during a three month period at an average daily rate of 2.1 million barrels per day.

18063 **(DOE/FE—0037) Strategic Petroleum Reserve. Quarterly report.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Strategic Petroleum Reserve). 15 Feb 1984. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007763.

This quarterly report is presented in five sections. The introduction briefly discusses the Strategic Petroleum Reserve (SPR) program background and report requirements. Site development is described in Section II and a report on oil acquisition activities is contained in Section III. Problems with oil acquisition and storage are discussed in Section IV. Section V contains information on the budget and cost of the Reserve. During the fourth quarter of 1983, the total inventory of oil stored in the SPR reached 379,088,828 barrels, more than half the program storage goal of 750 million barrels. The average fill rate for the calendar year 1983 was approximately 233,594 barrels per day. The Department of Energy continued to take advantage of favorable market conditions for the purchase of oil to fill available SPR storage capacity. The SPR was filled at a rate of 196,651 barrels per day during the calendar quarter ending December 31, 1983, and the weighted average delivered price of crude oil during this period was $30.59 per barrel. The

projected fill rate for the calendar quarter January 1, 1984 to March 31, 1984, is approximately 175,000 barrels per day. The projected fill rate for FY 1984 is 186,000 barrels per day. A successful drawdown exercise involving the movement of just over one million barrels of oil from underground caverns to aboveground facilities was conducted at the Bryan Mound site, November 3-4, 1983. This drawdown of more than one-million-barrels in one day exceeded the test objective of 900,000 barrels. 2 tables.

18064 **(DOE/IG—0204) Drawdown reliability of the Strategic Petroleum Reserve's Bryan Mound Site.** (USDOE Office of Inspector General, Washington, DC). 7 Mar 1984. 37p. TIC, PO Bx 62, Oak Ridge, TN 37831.

To The Secretary.

The Bryan Mound staff conducted a drawdown exercise which was closely observed by our inspection team. The Site successfully withdrew 1.007 million barrels (MMB) of crude oil during a 24-hour period of this exercise. This exceeds the present equipment design specification (.900 MMB/Day) by .107 MMB. Based on our evaluation of the system and the success of the exercise, we concluded that the Site very likely will be able to meet the Phase II and III drawdown goal of 1.054 MMB/D when the Phase II program is completed in 1986. There are, however, two problems that need special attention. First, inadequate maintenance could have a detrimental impact on the ability of the Site to conduct a sustained drawdown at the rate of 1.054 MMB/D. Second, the privately owned off-site oil transportation system may preclude the site from delivering crude oil to the users in accordance with the Phase II and III drawdown goal. The report describes these problems and other needed corrective actions in detail. In it we recommend ways to improve the ability of the Site to reliably meet the Phase II and III drawdown goal.

0250 Combustion

REFER ALSO TO CITATION(S) 18319

03 NATURAL GAS

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 18042, 18043

18065 **(BMFT-FB-T—83-190) Further development of magnetotelluric methods for the exploration of the pre-Zechstein by improvement of the data processing codes, data acquisition and interpretation techniques.** Mueller, W.; Losecke, W.; Knoedel, K.; Rodemann, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 153p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750488.

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The goal of the project is to make improvements in the methods that (1) are necessary due to the special conditions present in Northern Germany (e.g. high background noise) and that (2) will reduce the time needed for the method (to increase its useability in industry) and increase its reliability. The following important results have been obtained: - improved computer programs for the direct interpretation of one-dimensional models; - a decrease in the time needed for the measuring and processing steps by construction of a second measuring system, expansion of the computer system of the first set of equipment for multiprogramming operations and data processing in the field, as well as equipping both systems for remote reference operations; - a newly developed processing program to reduce scatter and systematic error and to be able to carry out a data analysis for the remote reference method. The results obtained in this project can be used for exploring the pre-Zechstein sediment basins of Northern Germany, for locating plutons in areas where hydrocarbon prospecting is envisaged, and for the exploration of sediment sequences under alpine and volcanic cover.

18066 **(DOE/NV/10249—7) Western Gas Sands Project. Annual report, October 1981-September 1982.** (CER Corp., Las Vegas, NV (USA)). Feb 1983. Contract AC08-82NV10249. 57p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009177.

This is the first annual report of Contract AC08-82NV10249, which was initiated on November 30, 1981, and covers the period from that date to December 31, 1982. The contractual technical work has been divided into seven task assignments: (1) plan and control program; (2) report program activities; (3) improve conventional log interpretation techniques; (4) improve reservoir analysis; (5) develop/improve instrumentation; (6) operate and maintain well testing unit; and (7) support field experiments. This report addresses each task assignment individually and describes the technical activities that have occurred and the technical results and accomplishments that have been generated in the course of this contract. Much of the work in this contract relates to the Department of Energy's Multi-Well Experiment. This experiment is located in the Rulison Field in Colorado's Piceance Basin and has two objectives: Characterization of low permeability, lenticular gas sands. Evaluation of state-of-the-art and developing technology for producing from these sands. The lenticular Mesaverde sequence and the underlying blanket Corcoran-Cozzette are the zones of interest, lying at depths between 4000 and 8600 ft. During this reporting period, the Multi-Well Experiment involved two wells, MWX-1 and MWX-2. Both wells penetrate the Corcoran-Cozzette and the surface location of MWX-2 lies 138 ft southwest of MWX-1. A complete description of the MWX site and MWX-1 and MWX-2 wells are provided in Sandia Reports 82-7201 and 82-7100. 2 references, 27 figures, 2 tables.

18067 **(DOE/NV/10249—T2) Task progress reports. Fourth quarter, October-December 1983.** Murphy, W.O. (CER Corp., Las Vegas, NV (USA)). 10 Jan 1984. Contract AC08-82NV10249. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008234.

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The objective of this project is to provide technical and administrative support to the Western Gas Sands project. Progress reports are presented for the following tasks: task assignment 1-A, support and control program; task assignment 3-A, improve conventional log interpretation techniques; task assignment 4-A, improve reservoir analysis; task assignment 6-A, operate and maintain well testing unit; and task assignment 8, develop/improve geological understanding. 2 figures.

18068 **(DOE/NV/10249—T3) Task progress reports. First quarter, January-March 1983.** Murphy, W.O. (CER Corp., Las Vegas, NV (USA)). 28 Jun 1983. Contract AC08-82NV10249. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009165.

The objective of this project is to provide technical and administrative support to the Western Gas Sands project. Accomplishments for the past quarter are presented for the following task assignments: No. 1-A, support and control program; No. 3-A, improve conventional log interpretation techniques; No. 4-A, improve reservoir analysis; No. 6-A, operate and maintain well testing unit; and No. 8, develop/improve geological understanding. Some of the highlights are: log analysis techniques developed from MWX data were being applied to the Mobil 31-13G well in the Piceance Basin; petrographic data obtained from analysis of MWX core were being entered into the MWX data base; BETC BOAST black oil reservoir model was reviewed and evaluated and suggestions were made as to modifications that would improve reservoir performance predictions; METC SUGAR and SUGARMD gas reservoir models were reviewed and evaluated and suggestions for modifications were made; and a paper that uses the correlation of logs from closely spaced wells to describe the dimensions of sand lenses in the Mesaverde formation of the Piceance Basin was completed.

18069 **(DOE/NV/10249—T4) Task progress reports. Second quarter, April-June 1983.** Murphy, W.O. (CER Corp., Las Vegas, NV (USA)). 9 Nov 1983. Contract AC08-82NV10249. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009166.

The objective of this project is to provide technical and administrative support to the Western Gas Sands project. Progress reports are presented for the following task assignments: No. 1-A, support and control program; No. 3-A, improve conventional log interpretation techniques; No. 4-A, improve reservoir analysis; No. 6-A, operate and maintain well testing unit; and No. 8, develop/improve geological understanding. Some of the highlights are: two significant modifications to the TITEGAS log analysis program were made; studies of lithologic log data have led to a new approach of determining the volume of carbonate material in shaly sand formation; an algorithm has been developed for correlating neutron logs for borehole effects when run in oil-based mud; an algorithm for calculating excavation effects on neutron logs in tight sands has also been developed; and preliminary analysis and preparations for installing the METC, SUGAR and SUGARMD fractured gas reservoir models on the CER VAX computer were largely completed.

18070 **(DOE/NV/10249—T5) Task progress reports. Third quarter, July-September 1983.** Murphy, W.O. (CER Corp., Las Vegas, NV (USA)). 15 Nov 1983. Contract AC08-82NV10249. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008233.

The objective of this project is to provide technical and administrative support to the Western Gas Sands project. Brief progress reports are presented for the following task assignments: No. 1-A, support and control program; No. 3-A, improve conventional log interpretation techniques; No. 4-A, improve reservoir analysis; and No. 6-A, operate and maintain well testing unit. Some of the highlights are: a study of Sidewall Neutron Porosity (SNP) data from the MWX-2 well was started, utilizing the TITEGAS log analysis computer program; log analysis techniques developed from MWX data have been applied to tight sand intervals in the Mobil F-31-13G well which is in the Piceance Basin; SUGARWAT fractured gas reservoir model, which is a modification of the METC SUGARMD model, was made operational on the CER VAX computer; and viability and limitations of using the DOE/CER reservoir model in analyzing data from three-well interference testing in unfractured tight sands were investigated.

18071 **(SAND—83-0060) Depth of penetration achieved by instrumented seabed penetrators during initial systems demonstration tests.** Calloway, T.M. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008055.

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Two versions of a gun-launched Instrumented Seabed Penetrator (ISP-1 and ISP-2) were tested in the Gulf of Mexico in May 1982. In each case the gun was loaded with propellant and a penetrator, lowered to the seabed, then fired. ISP-1 traveled 28 m into the seabed, and ISP-2 traveled 36 m. ISP-1 determined its displacement from the gun by means of an on-board accelerometer and microprocessor; after coming to rest, it used an Explosive Acoustic Telemetry System to transmit this information. ISP-2 was connected to the gun with a wire rope which unspooled during flight, allowing the instrumentation package to be retrieved. The measured deceleration profiles from the instrumentation's data memory were then processed off-line to compute the speed and displacement of ISP-2 as a function of time. 14 references, 5 figures, 4 tables.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 18020

0306 Marketing And Economics

18072 **(CONF-8303135—1) Future US gas markets in an era of low oil prices and implications for Canadian producers.** Guth, L. (National Economic Research Associates, New York (USA)). 10 Mar 1983. 26p. NTIS, PC A03/MF A01. Order Number DE84900866.

From 4. crossborder seminar; Calgary, Alberta, Canada (10 Mar 1983).

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Some key considerations in analyzing future US gas markets are: economic growth in the US; level of world oil prices; relationship of residual fuel oil to crude oil prices; relationship of natural gas to crude oil price, which in turn will depend on size and location of natural gas resource base available to the US. The combination of (1) lower projected average acquisition costs for natural gas consistent with a low world oil price scenario, and (2) the move to a deregulated and competitive natural gas market are likely to place continuing pressure on a $4.94 border price for Canadian natural gas. 10 figures, 10 tables.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 19122

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 18067

18073 **(SAND—84-0554C) Fracture diagnostics results for the Multi-Well Experiment's paludal zone stimulation.** Hart, C.M.; Engi, D.; Morris, H.E.; Fleming, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 17p. (CONF-8405120—3). NTIS, PC A02; 3; GPO Dep. Order Number DE84008294.

From SPE/DOE/GRI gas recovery symposium; Pittsburgh, PA, USA (13 May 1984).

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A dual seismic system designed to monitor the growth of hydrofractures was fielded during the first stimulation at the DOE-sponsored Multi-Well Experiment (MWX) during December 1983. The MWX consists of three 8000-ft wells which have been drilled in low permeability gas reservoirs. The wellbores are spaced less than 200 ft apart over most of their length. With this configuration, microseismic activity created by the fracture treatment in one well could be observed with downhole geophone packages in the two adjacent wells. The responses of the two triaxial borehole seismic tools were monitored in real time and analyzed post-fracture. Upon the detection of a seismic event of known location, orientations of the tools were determined from the polarization of the compressional wave arrivals. From knowledge of the horizontal and vertical angles of incidence and an empirical estimate of seismic velocities, the location of the fracture induced seismic sources was estimated. Thus, the location of the microseisms could be estimated and, in turn, the fracture height and extent inferred. This paper presents the results of the fracture diagnostics using this borehole seismic system for the first MWX stimulation. This information is compared to and combined with the results obtained from other diagnostic techniques to provide an integrated estimate of the fracture geometry resulting from the stimulation. 15 references, 10 figures, 1 table.

18074 **Early production from some Devonian Shale gas wells stimulated with several kinds of explosive charge.** Coursen, D.L. (E.I. du Pont de Nemours & Co., Inc.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE 12322**: 217-224(Nov 1983). (CONF-8311107—). Contract AC21-79MC11843.

From Society of Petroleum Engineers of AIME eastern regional meeting; Champion, PA, USA (9 Nov 1983).

Early cumulative production from Devonian Shale gas wells stimulated with a high energy water gel explosive averaged 2 times that from nearby wells stimulated with dynamite. From an estimate of production loss due to well damage done by post-shot drilling in the shot zone, it is concluded that production from the wells stimulated with water gel would have averaged 5 times that from dynamite stimulations if no such drilling had been done.

18075 **Practical aspects of foam fracturing in the Devonian shale.** Komar, C.A. (Dept. of Energy, Washington, DC); Yost, A.B.; Sinclair, A.R. *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* 1-12(Sep 1979).

Available data on foam frac treatments from DOE/industry cooperative ventures and the state-of-the-art in the formulation of foam fluids for hydraulically fracturing the Devonian shale are reviewed and discussed in light of an engineering measurement of factors affecting cleanup, induced geometry, production and cost. The benefits and limitations of foam as the fracturing fluid for the Devonian shale are discussed and evidence supporting the observations are exhibited. Special laboratory studies on formation damage and fracture conductivity impairment associated with fracture treatments using water based fluids and foam are reviewed as well. Rationale for selection of parameters used in the development of foam frac designs are set forth and limitations affecting universal applicability of foam frac stimulations are identified. Results of early well life production rates are reviewed in light of necessary costs for achievement of the limited foam frac stimulations conducted. Overall, these treatments appear to be quite suited for the Devonian shale since the formation is shallow, exists at a low temperature and is composed of a low permeability rock that requires minimal contact time with fracturing fluids to avoid being damaged and to preclude interference with gas production from the native fracture system. Prospects for development wherein foam fracturing may be likely to succeed in linking the reservoir capacity with the wellbore are identified based on the stress ratio concept. 6 figures, 6 tables.

0330 Properties

18076 **(PB—84-134386) Analyses of natural gases, 1982. Information circular/1983.** Miller, R.D.; Hertweck, F.R. Jr. (Bureau of Mines, Washington, DC (USA)). 1983. 98p. (BM-IC—8942). NTIS, PC A05/MF A01.

This Bureau of Mines publication contains analyses and related source data for 271 natural gas samples from 22 States collected during calendar year 1982. All samples were obtained and analyzed as part of Bureau of Mines investigations of the occurrences of helium in natural gases of countries with free market economies. This survey has been conducted since 1917. The analyses published herein were made by the mass spectrometer and chromatograph.

0340 Combustion

18077 **(NP—4770172) Electric sparks and exploding wires as ignition sources of combustible methane-air-mixtures.** Filip, A. (Eidgenoessische Materialpruefungs- und Versuchsanstalt fuer Industrie, Bauwesen und Gewerbe, Duebendorf (Switzerland)). 1982. 119p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770172.

A test equipment was set up allowing an experimental comparison of the ignition effect of electric sparks and exploding wires. The following experiments were carried out: measurement of the power function during discharge and the resulting ignition energy, measurement of spherical shock waves, photographic comparison of electric sparks and exploding wires by means of a high speed camera and IR-photographs and comparison of the ignition effect of these 2 sources by instigation of a deflagration in methane-air-mixture at 20°C and atmospheric pressure. The results show that ignition of combustible gases is determined mainly by heat which is conducted from the ignition source into the gas. Spherical shock waves are of secondary importance for ignition. They cause expansion of the ignition source and thus promote the heat conductivity into the gas. Finally the lower flammability limit of methane-air-mixture under conditions of atmospheric pressure and temperature was determined. The influence of wire material and wire diamter on the ignition effect was investigated. It appears that different ignition effects depend not only on the heat conductivity from the ignition source into the gas but also on the inhibition effect of ionized copper vapour on the radical reactions during ignition. The lower flammability limit was found not to depend on the ignition energy.

18078 **(PB—84-128826) Technical aspects of CNG.** Stephenson, J.; Jones, K. (New Zealand Energy Research and Development Committee, Auckland). Jul 1983. 97p. (R—91). NTIS, PC E05/MF E01.

This report contains the following information: the volumetric Efficiency of Engines using Liquid and Gaseous Fuels (Why do CNG vehicles suffer a power loss.); Facilities and Procedures for CNG Testing at the University of Auckland. (What tests are the University of Auckland CNG Research Group able to do.); Carbon Monoxide Exhaust Emissions and the CNG Engine. (How can a CO exhaust emissions analyser be used to get the best fuel economy.); Ignition Timing and the Performance of a Dual-Fuel CNG-Petrol Engine. (How should ignition timing be set.); Ignition System Performance and Requirements for Dual Fuel CNG-Petrol Operation. (What are the spark plug temperature and voltage requirements.)

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 18090

0402 Site Geology And Hydrology

18079 **(DOE/R4/10193—T4) Converting Chattanooga oil shale to synthetic liquid fuel. Phase I. Final report.** (Tennessee Technological Univ., Cookeville (USA). Office of Research). Jan 1981. Contract FG44-80R410193. 218p. NTIS, PC A10/MF A01; GPO Dep. Order Number DE84005853.

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The Chattanooga Shale is widely distributed in Tennessee and has been known as a potential source of shale oil and strategic minerals, particularly uranium, for many years. It was studied in the late 1940's as a source of uranium. The shale varies in color from light gray to black. The shale is of the Devonian Age and occurs under the Maury formation and above the Leipers limestone. It exists as the Gassaway and Dowelltown members. Generally, the combined thickness of these two members in the seven-county study ranged in thickness from about 26 feet to greater than 34 feet. The overall intent of this study was to identify the extent of the Chattanooga shale in Tennessee, characterize its properties, review its potential as an oil producer in terms of present-day technologies, and to assess interest in the private sector for development and commercialization. This report contains the results of this six-month study. 28 figures, 58 tables.

18080 **(USGS-OFR—82-965) Results of USGS oil-shale core drilling in the eastern Uinta Basin, Utah: Red Wash-1 drill hole.** Scott, R.W. Jr.; Pantea, M.P. (Geological Survey, Denver, CO (USA)). 1982. 41p. USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Two oil-shale core holes were drilled in the eastern Uinta Basin, Utah by the US Geological Survey during the fall and winter of 1981-1982. These holes were drilled for the purpose of oil-shale resource evaluation in the presumed depositional center of the rich oil-shale sequence in the basin. The drilling operations were contracted by the US Geological Survey to Connors Drilling, Inc. of Lakewood, Colorado, and the field descriptions of the cuttings and core were done by Ameraldo Resources, Inc. of Denver, Colorado, with revisions by the US Geological Survey. Geophysical logging was done by BPB, Inc. of Grand Junction, Colorado, and the Fischer assay analysis of the core was performed by Dickinson Laboratories, Inc. of El Paso, Texas. The water quality data were made available by Walt Holmes and Mike Enright of the US Geological Survey in Salt Lake City, Utah. Future work with the core material from the Red Wash-1 (RW-1) drill hole includes analysis of a composite standard sample of oil shale from the Mahogany oil-shale zone (which, in this hole, includes material from 2600.0 feet deep to 2733.0 feet deep) for major, minor, and trace elements by the US Geological Survey. The core material is stored at the US Geological Survey core storage facility in Arvada, Colorado. 3 figures, 1 table.

18081 **(USGS-OFR—82-966) Results of USGS oil-shale core drilling in the eastern Uinta Basin, Utah: Coyote Wash-1 drill hole.** Scott, R.W. Jr.; Pantea, M.P. (Geological Survey, Denver, CO (USA)). 1982. 61p. USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Two oil-shale core holes were drilled in the eastern Uinta Basin, Utah, by the US Geological Survey (USGS) during the fall and winter of 1981-1982. These holes were drilled for the purpose of oil-shale resource evaluation in the presumed depositional center of the rich oil-shale sequence in the basin. The drilling operations were contracted by the US Geological Survey to Connors Drilling, Inc. of Lakewood, Colorado, and the field descriptions of the cuttings and core were done by Ameralda Resources, Inc. of Denver, Colorado, with revisions by the USGS. Geophysical logging was done by BPB, Inc. of Grand Junction, Colorado, and the Fischer assay analysis of the core was performed by Dickenson Laboratories, Inc. of El Paso, Texas. The water quality data were made available by Walt Holmes and Mike Enright of the USGS in Salt Lake City, Utah. Future work with the core material from the Coyote Wash-1 (CW-1) drill hole includes analysis of a composite standard sample of oil shale from the Mahogany oil-shale zone (which, in this hole, includes material from 2195.0 feet deep to 2323.0 feet deep) for major, minor, and trace elements. The core material is stored at the USGS core storage facility in Arvada, Colorado. 3 figures, 1 table.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 17939, 18079, 18088, 18089, 18089, 18093

18082 **Fluidized bed - thermal pyrolysis process for the recovery of a bitumen-derived liquid from the bitumen-impregnated sandstone deposits of Utah.** Venkatesan, V.N. (Mobil Research and Development Corp., Dallas, TX); Hanson, F.V.; Oblad, A.G. pp 42-55 of Processing of energy and metallic minerals. Sohn, H.Y.; Hill, S.D.; Wie, J.M.; Sastry, K.V.S. (eds.). New York, NY; American Inst. of Chemical Engineers (1982). (CONF-810417—Vol.1).

From 90. AIChE national meeting; Houston, TX, USA (5 Apr 1981).

The bitumen-impregnated sandstone deposits of Utah are estimated to contain a minimum of 25 billion barrels of oil in place in six major deposits and are the largest known hydrocarbon resource of this type in the United States. The deposits of the Unitah Basin are of fresh water origin with bitumen concentrations that range from 4 to 12% by weight and contain less than 0.5 to 1.0% by weight sulfur. The deposits in southeastern Utah are of marine origin with bitumen concentrations of 4 to 5% by weight and contain 4 to 6% by weight sulfur. The Sunnyside (fresh water origin) and Tar Sand Triangle (marine origin) were processed in an aboveground, fluidized bed thermal recovery process. The experimental data were obtained in the temperature range 675 K to 900 K at solids retention times in the range 20 to 32 minutes. The amount of bitumen converted to coke on the sand was relatively insensitive to the process operating conditions, the sand particle size, the origin of the sand or the amount of bitumen on the fresh sand. The maximum liquid yield with the bitumen-impregnated sand from the Sunnyside deposit was 70% by weight of the bitumen fed to the reactor, was obtained at 773 K and a solids retention time of 20.4 minutes for a feed particle size of 358.5 microns. The maximum liquid yield with sand from the Tar Sand Triangle deposit was 50% by weight, was obtained at 798 K and a solids retention time of 27.2 minutes for a feed particle size of 358.5 microns. The liquid yield increased with decreasing sand retention time and it appears 80% of the bitumen can be converted to a pipelineable liquid product at sand retention times below 20 minutes. 12 figures, 14 tables.

0405 Properties And Composition

18083 **A field test of the strain recovery method of stress determination in Devonian shale.** Blanton, T.L.; Teufel, L.W. (Science Applications Inc.). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE 12304**: 71-80(Nov 1983). (CONF-8311107—). Contract AC04-76DP00789.

From Society of Petroleum Engineers of AIME eastern regional meeting; Champion, PA, USA (9 Nov 1983).

The strain recovery approach to in situ stress determination was applied to transversely isotropic Devonian shale core obtained from Meigs County, Ohio. The temperature-corrected recovery strains showed expansion in all directions for a period of about 30 hours. During this time, the average azimuth of the maximum recovery strain was N70E + or - 2^0. The calculated magnitudes of the maximum and minimum horizontal compressive stresses were about 1.5 times and .8 times the overburden, respectively. Attempts to measure the stresses by hydraulic fracturing at the same site produced inconclusive results. However, the results of the strain recovery approach at Meigs County appear to be consistent with published results from hydraulic fracturing measurements made in other parts of the Appalachian Basin.

18084 **Pyrolysis kinetics for Green River oil shale from the saline zone.** Burnham, A.K.; Huss, E.B.; Singleton, M.F. (Lawrence Livermore National Laboratory, Livermore, CA). *Fuel;* **62**: No. 10, 1199-1204(Oct 1983). Contract W-7405-ENG-48.

The nature of the organic and mineral reactions during the pyrolysis of Saline-zone Colorado oil shale containing large amounts of nahcolite and dawsonite has been determined. Results reported include a material-balanced Fischer assay and measurements of gas evolution rate of CH_4, C_2H/SUB x/, H_2, CO and CO_2. Stoichiometry and kinetics of the organic pyrolysis reactions are similar to oil shale from the Mahogany zone. X-ray diffraction and thermogravimetric analysis results are used to help determine the characteristics of the mineral reactions. Kinetic expressions are reported for dawsonite decomposition, and it is demonstrated that the temperature of dolomite decomposition is substantially lower than Mahogany-zone shale because of the presence of the sodium minerals.

18085 **Acoustic wave propagation in oil shale: 1. Experiments.** Marz, T.; DuBow, J.; Rajeshwar, K. (Department of Electrical Engineering, Colorado State University, Fort Collins, CO). *Fuel;* **62**: No. 10, 1215-1222(Oct 1983).

This study examines the propagation characteristics of compressional (P) and shear (S) acoustic waves through cored and broken Green River oil shale specimens. Both compressional and shear wave velocities (V/SUB p/ and V/SUB s/) are sensitive to shale organic content, showing a monotonic decrease with increasing organic content in the range 30-200 L/t. Trends in the dependence of V/SUB p/ and V/SUB s/ on temperature are explained by thermal alterations in the shale matrix which include release of free and bound water molecules, pyrolysis of organic matter and re-cementation of the shale matrix by the products of pyrolysis. The temperature dependence of V/SUB p/ and V/SUB s/ is less pronounced when the acoustic energy propagates in a plane parallel to the shale bedding planes. Channelling of acoustic energy via mineral-rich layers has been invoked to explain the anisotropy. The degree of anisotropy is also dependent on shale organic content; the differences becoming less pronounced at high levels of organic content. Data on V/SUB p/ and V/SUB s/ for burnt and retorted shales show minimal temperature dependence, although these values are sensitive to the initial organic content of the material. Finally, measurements on broken pieces of shale reveal the expected increase in V/SUB p/ and V/SUB s/ with increasing compaction pressure. The decrease in V/SUB p/ and V/SUB s/ with decreasing particle size down to 0.6-0.3 mm is rather anomalous and can be explained only by the presence of a large number of narrow voids in the material.

18086 **Uranium content of Amazon oil shale determined by SSNTD.** Paschoa, A.S.; Ferro, A.L.; Mafra, O.Y. (University of Utah, Salt Lake City, UT 84112). *Transactions of the American Nuclear Society;* **45**: 60-61(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18087 Electrical conductivity of Colorado oil shale to 900°C. Duba, A. (Lawrence Livermore National Laboratory, University of California, Livermore, CA). *Fuel;* **62**: No. 8, 966-972(Aug 1983). Contract W-7405-ENG-48.

Electrical conductivity of oil shale from the Anvil Points Mine, Colorado was measured to temperatures >900°C with conductance bridges operating at frequencies from 100 to 100 000 Hz. The conductivity of low, intermediate and high grade oil shales (15,124,233 $mlkg^{-1}$, respectively) is dependent on water content up to approx. 100°C. At approx. 120°C, values of conductivity at approx. 10^{-7} S m^{-1} are observed for all grades. A strong, time-dependent, increase in conductivity, beginning at ≈400°C, marks the loss of light hydrocarbons and the formation of a conductive char. The frequency dependence of conductivity slightly less than a decade increase in conductivity per decade increase in frequency over the temperature range 100-400°C-vanishes at temperatures near 500°C. At 600-800°C, the conductivity of these oil shales reaches a maximum value which is as much as 10^8 times larger than the conductivity near 250°C.

18088 Composition and kinetics of oil generation from non-isothermal oil shale retorting. Wang, C.C.; Noble, R.D. (University of Wyoming, Chemical Engineering Department, Laramie, WY). *Fuel;* **62**: No. 5, 529-533(May 1983). Contract AC20-78ET13101.

Oil shale retorting has been carried out under non-isothermal conditions between 623 and 773 K and at different pressures (78 and 765 kPa). The shale oil is separated into five individual components: polar, weak polar, saturates, aromatics and olefin, using a comprehensive analytical procedure. The effects of retorting pressure and heating rate have been studied. The oil yield under high pressure (765 kPa) is ≈ 10% less than the oil yield under ambient pressure (78 kPa). Much of this reduced yield can be accounted for by the reduced amount of polar component formed at high pressure. Heating rates of 1.67 x 10^{-2}, 6.67 x 10^{-2} and 8.33 x $10^{-2}Ks^{-1}$ have been used; a higher heating rate causes a delay in the appearance of the oil. A simplified kinetic scheme is proposed which includes the distribution of liquid products and pressure effects. The activation energies and frequency factors of generation reactions for total oil and individual components have been obtained.

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 18079

18089 (DOE/ET/14167—T1) Economic comparisons of oil shale synthetic fuel processes. Task 1 report. (International Research and Technology Corp., McLean, VA (USA)). Jun 1980. Contract AC01-79ET14167. 29p. NTIS, PC A03/MF A01. Order Number DE83017126.

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A cost and performance data base is being developed for alternative oil shale retorting technologies and these data are being incorporated into the Materials-Process-Product Model (MPPM). This model is a computer program to permit analysis of the functional response of capital cost, operating cost, and product price to different sets of process and financial parameters. The COSTER routine within the MPPM program was revised to conform to ESCOE guidelines for reporting and analyzing cost information on synthetic fuel plants. The technologies selected for analysis were: TOSCO II, Paraho indirect, Oxy Modified In-Situ, and conceptual modified in-situ design by Fenix and Scisson Inc. Topics considered include: escalation factors, financial parameters, inputs to the COSTER model for the economic analysis of oil shale recovery processes, and economic analysis outputs of the COSTER model.

18090 Potential for commercial oil shale activities in Australia. Petzrick, P.A. (Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Coal Liquids Department of Energy, Washington, DC). *Energy (Stamford, Connecticut);* **8**: No. 3, 15-16(Spr 1983).

Oil shale has been produced in Australia in all but seven years of the 87 year period from 1865 to 1952. The final cessation of production in 1952 was due to exhaustion of the best resources in the vicinity of the operating plant and to renewed pressure from imported crude oil. If conditions had been more favorable, production could have continued. There is current potential for commercial oil shale activity in three of Australia's states, namely New South Wales, Tasmania and Queensland. In New South Wales, it seems likely more of the rich resources will be found, most likely in the deeper portions of the Permian coal measures. The lenticular deposits are suited to working by smaller projects more consistent with the current investment strategy of many companies. In Tasmania, the prospects for cogeneration or integrated projects coproducing electricity, liquids, industrial gas, and cement appear most suitable. In Queensland, the prospects for cheaper open pit operations are good. The prospects for finding more resources with new geologic techniques is particularly high. In all three states, the proximity of resources to infrastructure and favorable climate are advantages. The favorable characteristics of oil shale discovered so far, and the inherited resourcefulness of the people, seem to assure that development will occur when truly needed. Highlights follow to substantiate these conclusions.

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 19094

18091 (PB—84-129600) Revegetating processed oil shale in the upper mountainbrush zone of Colorado. Forest service research paper. Ferguson, R.B.; Frischknecht, N.C. (Forest Service, Ogden, UT (USA). Intermountain Forest and Range Experiment Station). Nov 1983. 13p. NTIS, PC A02/MF A01.

This study was designed to provide information on methods to establish vegetation on processed oil shale disposal areas without using large volumes of water to leach salts from the processed shale. A secondary objective was to evaluate several species of plants for their adaptability to the soil material and climatic conditions at the study site.

18092 (PB—84-130483) Green river ambient model assessment program. Interim report Jun 80-Jun 83. Schiermeier, F.A.; Huber, A.H.; Whiteman, C.D.; Allwine, K.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). 1983. 20p. (EPA—600/D-84-027). NTIS, PC A02/MF A01.

Due to the proposed development of the Green River Oil Shale Formation encompassing the areas of southwestern Wyoming, northeastern Utah, and northwestern Colorado, the EPA Region VIII Headquarters in Denver has a specific need for the development of site-specific ambient dispersion models. To meet this requirement, the Green River Ambient Model Assessment (GRAMA) project was initiated to develop improved air quality models for analyzing the impacts of the oil shale industry with respect to PSD increments over pristine wilderness areas, and ambient air quality standards for criteria pollutants. Two air quality simulation models are currently under development for this complex region. One model, VALMET, is a local-scale model for predicting concentrations of nonreactive pollutants within a well-defined mountain valley configuration. The second model, MELSAR, is a mesoscale Lagrangian puff model for predicting pollutant concentrations within a 500 km by 450 km region. This paper gives a description of the current VALMET model followed by brief explanations of the MELSAR model and the GRAMA field experiments. The paper concludes with a summary of the GRAMA project.

18093 Effect of groundwater and pH modification on quality of leachate from simulated in-situ retorted Utah Oil Shale. Bethea, R.M.; Barber, D.R.; Guven, N.; Parker, H.W. (Texas Tech University). *SPEJ, Society of Petroleum Engineers Journal;* **23**: No. 5, 809-818(Oct 1983). Contract FG03-78ET13084.

Major variables reported in this study were retorting temperature, retorting atmosphere (inert, air added, air and CO_2 added), and groundwater quality (source). All leaching tests were made at atmospheric pressure and most at room temperature. Leaching tests were made with groundwater to observe the ability of spent shale to remove materials from groundwater and the possible ability of

those materials to plug the pore structure of the spent shale and to minimize further leaching. The factor having the greatest effect on leachate composition was retort temperature. The presence of CO_2 during hightemperature retorting suppressed the amounts of base-forming materials generated. All leachates were affected significantly by the groundwater used for leaching. As expected, more material was leached from the retorted Utah shale when the higher-purity groundwater was used. The addition of 2% Wyoming bentonite for the purpose of pH modification to the groundwater used for leaching the retorted shale (780 and 1000°C (1,436 and 1,832°F) retort atmosphere of air with 15% CO_2 added) showed that the bentonite had only a small effect on the leaching of monovalent cations and essentially no effect on the movement of the heavy, hazardous cations. The effect of retorting temperature was mixed with the exception of chromium, which increased four- to fivefold in the leachate. The permeability of Utah shale was determined by retorting two cores from Rock 2 at 780°C (1,436°F) for 48 hours in the presence of air alone. The differences in the final permeability of these cores can be attributed to differences in groundwaters.

05 NUCLEAR FUELS

0501 Reserves

18094 **(USGS-OFR—78-964) Summary of the geology and resources of uranium in the San Juan Basin and adjacent region, New Mexico, Arizona, Utah, and Colorado.** Ridgley, J.L.; Green, M.W.; Pierson, C.T.; Finch, W.I.; Lupe, R.D. (Geological Survey, Denver, CO (USA)). Sep 1978. 147p. NTIS, PC A07. Order Number DE83902369.

Paper copy only, copy does not permit microfiche production.

Sedimentary rocks of Jurassic age in the southern part of the San Juan Basin contain the largest uranium deposits in the United States, and offer the promise of additional uranium deposits. Elsewhere in the basin and the adjacent Colorado Plateau, reserves and resources of uranium are known primarily in Triassic, Jurassic, and Cretaceous strata. Although uranium occurs in several formations and rock types within the area, the most important uranium deposits are contained in sandstone facies of the sequence, where geochemical and sedimentological conditions were most suitable for concentration of uranium. The distribution of sandstone and other favorable facies is controlled by the special distribution and association of sedimentary depositional environments operative during past geologic periods in the basin and on the Colorado Plateau. These environments of sedimentary deposition included a variety of both marine and continental types, such as deep and shallow marine, marginal marine, evaporite basin, fluvial, lacustrine, and desert eolian and sabkha. Uranium is most commonly associated with ancient continental stream and lake deposits of Jurassic age and marginal marine deposits of Cretaceous age. Most of the 120,000 tons of U_3O_8 produced in the area came from the Westwater Canyon and Brushy Basin Members of the Morrison Formation. The largest proportion of the reserves of 465,500 tons of U_3O_8 (at $50-per-pound forward cost) are in the area between Gallup and Laguna, New Mexico. Potential uranium resources, most of which remain undiscovered, total 826,600 tons U_3O_8 at $30-per-pound forward cost and are in the southern San Juan basin. The total resource base for the basin is about 1,500,000 tons U_3O_8 at a forward cost of $50-per-pound.

18095 **(USGS-OFR—79-968) Analytical data on the Schwartzwalder uranium deposit, Jefferson County, Colorado.** Young, E.J. (Geological Survey, Denver, CO (USA)). 1979. 36p. USGS Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

This set of 18 tables summarizes analytical data collected by the author during a study of the Schwartzwalder uranium deposit.

18096 **(USGS-OFR—79-994) Depositional environments of the uranium bearing Cutler Formations, Lisbon Valley, Utah.** Campbell, J.A.; Steele-Mallory, B.A. (Geological Survey, Denver, CO (USA)). 1979. 69p. USGS Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

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The Cutler Formation in Lisbon Valley, San Juan County, Utah, is composed predominantly of fluvial arkosic sandstones, siltstones, shales, and mudstones that were deposited by meandering streams that flowed across a flood plain and tidal flat close to sea level. Two types of channel deposits are recognized from their sedimentary structures: meandering and distributary. The flood plain was occasionally transgressed by a shallow sea from the west, resulting in the deposition of several thin limestones and marine sandstones. The marine sandstones were deposited as longshore bars. Wind transported sand along the shoreline of the shallow sea, forming a coastal dune field. Marine sandstones and eolian sandstones are more common in the upper Cutler in the southern part of the area, whereas in the central and northern part of the area the formation is predominantly fluvial. Crossbed orientation indicates that Cutler streams flowed S. 67° W. on the average, whereas marine currents moved sediment S. 36° E. and N. 24° W., and wind transported sand S. 80° E. The uranium in the Cutler is found in the central and northern part of the area, in the upper part of the formation, in small fluvial sandstone bodies that were deposited predominantly in a distributary environment. No uranium is known in the marine or eolian sandstones. Petrographically, the uranium-bearing sandstones are identical to other Cutler fluvial sandstones except that they contain less calcite and more clay and are slightly coarser grained. Ore formation has modified the host sandstones very little.

0502 Exploration

18097 **(USGS-OFR—79-996) Chemical data and statistical analyses from a uranium hydrogeochemical survey of the Rio Ojo Caliente drainage basin, New Mexico. Part I. Water.** Wenrich-Verbeek, K.J.; Suits, V.J. (Geological Survey, Reston, VA (USA)). 1979. 145p. USGS Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

This report presents the chemical analyses and statistical evaluation of 62 water samples collected in the north-central part of New Mexico near Rio Ojo Caliente. Both spring and surface-water samples were taken throughout the Rio Ojo Caliente drainage basin above and a few miles below the town of La Madera. A high U concentration (15 μg/l) found in the water of the Rio Ojo Caliente near La Madera, Rio Arriba County, New Mexico, during a regional sampling-technique study in August 1975 by the senior author, was investigated further in May 1976 to determine whether stream waters could be effectively used to trace the source of a U anomaly. A detailed study of the tributaries to the Rio Ojo Caliente, involving 29 samples, was conducted during a moderate discharge period, May 1976, so that small tributaries would contain water. This study isolated Canada de la Cueva as the tributary contributing the anomalous U, so that in May 1977, an extremely low discharge period due to the 1977 drought, an additional 33 samples were taken to further define the anomalous area. 6 references, 3 figures, 6 tables.

18098 **(USGS-OFR—79-1080) Uranium and thorium content of some sedimentary and igneous rocks from the Rolla 1° x 2° quadrangle, Missouri.** Odland, S.K.; Millard, H.T. Jr. (Geological Survey, Denver, CO (USA)). 1979. 17p. USGS-Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

Portions are illegible in microfiche products.

Uranium and thorium contents of 175 samples of Precambrian and overlying sedimentary rocks from 28 drill holes in the Rolla 1° x 2° quadrangle, Missouri, were determined in 1978 as part of the National Uranium Resource Evaluation (NURE) effort. The limited number of drill-hole samples analyzed and the great distance between drill holes does not provide sufficient analytical data for an evaluation of the uranium potential in this quadrangle. However, because NURE studies in the quadrangle have been recessed, the data at hand are being made available in this report. The 175 rock samples for uranium and thorium analyses were selected to determine the uranium and thorium content of lower Paleozoic stratigraphic units in the quadrangle, and to test the conceptual model of uranium accumulation in basal sandstones, conglomerates, and arkoses that onlap the Precambrian igneous rocks. The conceptual

model of uranium in intragranitic veins was not tested, because not all drill holes penetrate Precambrian rocks and none penetrate them more than a few meters.

18099 **(USGS-OFR—82-412) Uranium references index for the Navajo Indian Reservation, Arizona, New Mexico, and Utah.** Bliss, J.D. (Geological Survey, Menlo Park, CA (USA)). Feb 1982. 37p. USGS-OFS, Box 25425-Denver Federal Center, Denver, CO 80225.

The references listed in this document represent the readily available literature about uranium resources on or adjacent to the Navajo Indian Reservation. They were selected during the developmental phase of the Navajo Resource Information System (NRIS). The system contains a set of computerized data bases addressing various resource categories.

0503 Mining

18100 **(PB—84-141167) Environmental overview of unconventional extraction of uranium. Final report Nov 80-Feb 81.** Marlowe, J.I. (Wapora, Inc., Chevy Chase, MD (USA)). Jan 1984. 132p. NTIS, PC A07/MF A01.

Uranium mining areas in the United States are identified and briefly described, and the geologic, geochemical, and hydrologic factors associated with the various types of ore deposits are discussed. Uranium deposits that are now being mined or have recently been mined by solution-mining techniques are identified and briefly described; as well, deposits for which licenses have been obtained, but which thus far have not been mined, are listed. The techniques used in these processes of uranium extraction are described and discussed. The environmental impacts specifically associated with these methods of extracting uranium are identified, using examples from case histories of in situ mining operations. Impacts on groundwater are of the greatest concern, and problems associated with these impacts are discussed. The major adverse impact is contamination from the effects of lixiviant chemicals. Restoration to acceptable post-mining conditions is a major concern and technical problem. Existing or proposed technologies to prevent or to control pollution from in situ mining of uranium are identified and discussed, with emphasis on the problems associated with groundwater.

0504 Feed Processing

REFER ALSO TO CITATION(S) 18821

18101 (KAERI/RR—358/82, pp 231-281) **Studies on uranium ore processing and conservation.** Suh, I.S.; Kim, J.H.; Min, B.T.; Whang, S.C.; Im, K.S. (and others) (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A24/MF A01.

In Reduction of UFsub(4) to U metal: pt. 3.

The operating conditions for the production of uranium metal by reduction of UFsub(4) with magnesium powder have been thoroughly investigated using the reactor 1 Kg nominal capacity. UFsub(4) powders which were produced from the conversion plant in KAERI are used and MgFsub(2), by-product of the reduction, are used as liner after pulverizing. An average yield of 95% of uranium metal are obtained with 6% excess of magnesium powder in size of -Δo + 50 mesh and its density is 18.5 g/cc, and furthermore the yield is increased when magnesium powders are used after washed with trichloro-ethylene and dried.

18102 (KAERI/RR—358/82, pp 371-603) **Studies on uranium ore processing and conservation.** Suh, I.S.; Eum, T.Y.; Suh, M.Y.; Park, K.K.; Cho, K.S.; Chung, K.S.; Kim, J.S.; Song, B.C. 1983. (In Korean). NTIS (US Sales Only), PC A24/MF A01.

In Development of chemical analysis technique in nuclear fuel cycles: pt.5.

Distribution coefficients of some rare earth elements, Sm, Eu, Gd and Dy, between cation exchange resin and hydroxyisobulyric acid were determined. Sm, Eu, Gd and Dy in magnesium diuranate samples were separated chromatographically and found to be existing by an amount of 0.36, 0.18, 0.73 and 0.40ug/g of sample by fluorimetry. An apparatus and procedure for electroplating actinide elements was made and established. Percentage recoveries of the electrodeposition were 98.3% with +-0.7% reproducibility. By this method and alpha spectrometry, we obtained the atom ratio of U-238 and U-234 for a natural uranium sample of Korean originality (Kwe-San, Choong-Buk) as 1:6.1x10sup(-5). For a neutron-irradiated uranium sample electrodeposition and alpha spectrometry resulted in 2.39g/1, 0.620mg/1 and 1.24ug/1 for the concentration of U-238, Pu-239 and Am-241, respectively. Gamma ray emitters in the irradiated sample were determined by gamma spectrometry. After Pu and Np in the sample were separated by anion exchange chromatography and by TTA extraction each followed by alpha spectrometry, it was found that Pu-239 concentrations were 0.60 and 0.55mg/1 by each method. Isotope dilution analysis accompanied by ion exchange chromatography and mass spectrometry of the irradiated sample in purpose of U, Pu and Nd determination revealed U-238 concentration to be 2.48g/1.

18103 (KAERI/RR—358/82, pp 3-102) **Studies on uranium ore processing and conservation.** Suh, I.S.; Chun, J.K.; Park, S.W.; Choi, S.J.; Lee, C.H.; Chung, M.K.; Lim, J.K. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A24/MF A01.

In Studies on uranium or processing:pt.1.

For the exploitation of domestic uranium ore deposit, comprehensive studies on uranium ore processing of the Geum-San pit ore are carried out. Physical and chemical characteristics of the Geum-San ore are similar to those of Goe-San ore and the physical beneficiation could not be applicable. Optimum operating conditions such as uranium leaching, solid-liquid separation, solvent extraction and precipitation of yellow cake are found out and the results are confirmed by the continous operation of the micro-plant with the capacity of 50Kg, ore/day. In order to improve the process of the ore milling pilot plant installed recently, the feasibility of raffinate-recycle and the precipitation methods of yellow cake are intensively examined. It was suggested that the raffinate-recycle in the leaching of the filtering stage could reduce the environmental contamination and the peroxide precipitation technique was applicable to improve the purity of yellow cake. The mechanism and conditions of the third phase formation are thoroughly studied and confirmed by chemical analysis of the third phase actually formed during the operation of the pilot plant. The major constituents of the third phase are polyanions such as PMosub(12)Osub(40)sup(3-) or SiMosub(12)Osub(40)sup(4-) and the formation of these polyanions could be reduced by the control of redox potential and the addition of a modifier.

18104 (KAERI/RR—358/82, pp 103-229) **Studies on uranium ore processing and conservation.** Suh, I.S.; Lee, K.I.; Whang, S.T.; Kang, Y.H.; Lee, C.W.; Chu, J.O.; Lee, I.H.; Park, S.C. (and others) (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A24/MF A01.

In Test operation of the uranium ore processing pilot plant and uranium conversion plant:pt.2.

For the guarantee of acid leaching process of the Uranium Ore Processing Pilot Plant, the KAERI team performed the test operation in cooperation with the COGEMA engineers. The result of the operation was successful achieving the uranium leaching efficiency of 95%. Completing the guarantee test, a continuous test operation was shifted to reconfirm the reproducibility of the result and check the functions of every unit of the pilot plant feeding the low-grade domestic ore, the consistency of the facility was confirmed that the uranium can easily be dissolved out from the ore between the temperature range of 60degC-70degC for two hours of leaching with sulfuric acid and the leaching efficiency of 92% to 95% could be obtained. The uranium recovery efficiencies for the processes of extraction and stripping were reached to 99% and 99.6% respectively. As an alternative process for the separation of solid from the ore pulp, four of the Counter Current Decanters were shifted replacing the Belt Filter and those were connected in a series, which were not tested during the guarantee operation. It was found out that the washing efficiencies of the ore pulp in each test for the decanters were proportionally increased according to

the quantities of the washing water. As a result of the test, it was obtained that washing efficiencies were 95%, 85%, 83% for the water to ore ratio of 3:1, 2:1, 1.5:1 respectively.

18105 (KAERI/RR—358/82, pp 283-369) **Studies on uranium ore processing and conservation.** Suh, I.S.; Park, H.S.; Ryu, J.H.; Park, J.W.; Yang, H.B.; Chaung, M.S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A24/MF A01.

In Separation and purification of uranium and other metals by solvent extraction.

Chemical equilibrium data in the uranium extraction processes were obtained from the references and the experiments, and the systematical materials including the computer code, DUREX, for the design and development of the extraction processes were established on the basis of the collected data. An empirical equation for the zirconium extraction equilibrium constant with the ionic strength, was obtained from the experimental data and the decontamination factors can be estimated using this equation in uranium separation and purification processes. The enthalpy changes for uranium extraction reactions were measured through a thermodynamic approach. The experimental and analytical studies for the liquid membrane process were performed in order to develop a chemical recovery process for small amounts of metal. The mass transfer mechanism involved was also elucidated.

18106 **(KAERI/RR—358/82) Reduction of UF_4 to U metal. Part 3.** (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 570p. NTIS (US Sales Only), PC A24/MF A01. Order Number DE84780090.

Selected papers are indexed separately for inclusion in the Energy Data Base.

0505 Enrichment

REFER ALSO TO CITATION(S) 18262

18107 **(K-DSA—991) Safety analysis process at the Oak Ridge Gaseous Diffusion Plant.** Gamble, J.L. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 13 Mar 1984. Contract W-7405-ENG-26. 32p. (CONF-840392—3). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007472.

From DOE/ANL training course on prevention of significant nuclear events; Augusta, GA, USA (12 Mar 1984).

As a part of the safety documentation required by the Department of Energy for its non-reactor nuclear facilities a safety analysis is required. The analysis must assess the unique hazards in the operation of a facility, determine the safety system requirements, and quantify the residual risk. The unique hazards in the operation of the Oak Ridge Gaseous Diffusion Plant are nuclear criticality, penetrating radiation, and the release of toxic gas. This paper describes the process used to satisfy the safety analysis requirement, and gives some specific examples of its application.

18108 **(K/P—6790) History: safety in UF_6 handling.** Legeay, A.J. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 9 Mar 1984. Contract W-7405-ENG-26. 28p. (CONF-840392—4). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008007.

From DOE/ANL training course on prevention of significant nuclear events; Augusta, GA, USA (12 Mar 1984).

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Present operations involving UF_6 handling, UF_6 cylinder procurement and design and operation of new facilities are all governed by the recommendations of the UF_6 Cylinder Handling Committee and the guidelines set forth in three documents on UF_6 handling. These are: (a) ORO-651, Revision 4, Urban Hexafluoride: Handling Procedures and Container Criteria; (b) ANSI N14.1-1982, Packaging of Uranium Hexafluoride for Transport; and (c) DOE Order 5481.1A, Safety Analysis and Review System. Additionally, the UF_6 Cylinder Handling Committee has established a list of safety criteria to be used as guidelines for operating, modifying, or building systems for handling UF_6 where large releases could occur.

18109 **(UCRL—89132) Multi-user data acquisition environment.** Storch, N.A. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 10p. (CONF-8310168—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84001844.

From HP 1000 international users group conference; Fort Worth, TX, USA (18 Oct 1983).

The typical data acquisition environment involves data collection and monitoring by a single user. However, in order to support experiments on the Mars facility at Lawrence Livermore National Laboratory, we have had to create a multi-user data acquisition environment where any user can control the data acquisition and several users can monitor and analyze data being collected in real time. This paper describes how we accomplished this on an HP A600 computer. It focuses on the overall system description and user communication with the tasks within the system. Our current implementation is one phase of a long-term software development project.

18110 **(DP-tr—61) Effects of infrared lasers on chemical extraction reactions in liquid-liquid systems.** Baoyu, X. Translated from *Zhongguo Jiguang* ; **10**: No. 6, 354-357(1983). Contract AC09-76SR00001. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007462. DE84007462

A study was made of the effects of infrared lasers on equilibrium distributions of uranyl ions between aqueous solution phases containing nitric acid or hydrochloric acid and organic solvent phases of tributyl phosphate (TBP). The experimental results indicated that uranium concentrations in the organic solvent phase increased under TEA CO_2 laser irradiation up to a maximum of 44% as compared to cases in which laser radiation was not applied. The possibility that this type of laser extraction effect might be applied to separation of uranium isotopes was also discussed.

18111 **World nuclear fuel market: proceedings of the international conference on nuclear energy.** Atlanta, GA; Nuclear Assurance Corp. (1982). 158p. (CONF-8210237—). Nuclear Assurance Corp., 24 Executive Park West, Atlanta, GA 30329.

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

Thirteen papers, along with discussion and comments, are divided into four conference sessions covering: the prospect for primary markets for enriched uranium; secondary trading markets for enriched uranium; the management of irradiatied fuel and economics of reprocessing; and an evaluation of plutonium recycling in thermal reactors. The speakers address technical, economic, and political issues relating to both front-end and back-end management of the fuel cycle. The papers were presented at the 9th International Conference on Nuclear Energy in Nice, France during October, 1982. A separate abstract was prepared for each of the 13 papers selected for the Energy Data Base (EDB), Energy Research Abstracts (ERA), and Energy Abstracts for Policy Analysis (EAPA). (DCK)

18112 **United States enrichment supply - policy and direction.** Voigt, W.R. Jr.; Peske, S.E. (Dept. of Energy, Washington, DC). pp 1-11 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corporation (1982). (CONF-8210237—).

From 9: international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

Recognizing our position as the leader in commercial enrichment services, DOE has established a flexible approach to meeting changing market realities and customer needs. The major elements of this strategy are aggressive deployment of advanced technologies, more flexible contract terms and conditions, and near-term production optimization, all of which are based on a supply strategy which carefully balances near-term requirements with long-range responsibilities. The current surplus of separative work in the world market may afford some near-term opportunities for economy. However, a secure nuclear energy system must be based on assured long-term supply availability at reasonable prices. By utilizing the flexibilities of our large production base and maintaining our

demonstrated technological advantages, DOE is confident that the US will continue to be a vital and major competitor in the international nuclear fuel market. 4 figures

18113 **Long-term outlook of world enrichment supply.** Rougeau, J.P. (Societe EURODIF, Bagneux, France). pp 12-18 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

The uranium enrichment industry must equip itself rapidly to meet the growing requirements of electricity production. With a more stable demand, the industry is going to dedicate the next 20 years to optimizing its growth, along with the quality and diversity of its services, so that it can better adapt to utility requirements. Electricity producers should be aware that this crucial link in the fuel cycle is solid, and that they are insured long-term supplies as well as the possibility of diversifying their sources. Conditions also allow the supply of these enrichment services at prices based upon a fair evaluation of industrial costs, which is a guarantee against speculative or conjunctural fluctuations.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 18259, 18260, 18271, 18457

18114 **(GKSS—83/E/26) Qualification of U_3O_8 as research reactor fuel.** Krull, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Zentralabteilung Forschungsreaktoren). 1983. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750857.

This report summarizes the current knowledge of the qualification status of U_3O_8 as low enriched (< 20%) fuel for research reactors. Described and discussed are experiences with high enriched fuel, tests and post irradiation examination of low enriched fuel plates and fuel elements, fission product release and accidental conditions. It is shown, that U_3O_8 is so far qualified to start testing of ten (10) fuel elements with an U-density of 3.1 g U/cc in the FRG-2 research reactor.

18115 **(HEDL-SA—2969-FP) Automated manufacturing of breeder reactor fuels.** Nyman, D.H.; Benson, E.M.; Bennett, D.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1983. Contract AC06-76FF02170. 8p. (CONF-840202—16). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007179.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

The Secure Automated Fabrication (SAF) line is an automated, remotely controlled breeder fuel pin fabrication process which is to be installed in the Fuels and Materials Examination Facility (FMEF). The FMEF is presently under construction at Hanford and is scheduled for completion in 1984. The SAF line is scheduled for startup in 1987 and will produce mixed uranium-plutonium oxide fuel pins for the Fast Flux Test Facility (FFTF). Radiological protection requirements, computer control equipment, use of robotics, and the fabrication process is described.

18116 **(Juel—1610) Investigations on the pyrolysis of hydrocarbons in the inductive coupled RF-plasma and the deposited pyrocarbon.** Eisgruber, H.; Mazurkiewicz, M.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Aug 1979. 140p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750747.

The pyrocarbon coatings of the nuclear fuel particles for the High-Temperature Reactor (HTR) are produced by pyrolysis of hydrocarbons under high temperatures. The investigations of the inductive coupled argon or argon/hydrocarbon-plasma performed in the frame of this work deliver a contribution for the clarification of pyrolysis processes and the production of pyrolytic carbons in the plasma of an electric discharge. The argon-plasma, as high-temperature source, is diagnosed theoretically and emission-spectroscopically. To the pure argon-plasma the various hydrocarbons are added. Due to the thermal decomposition the carbon is separated in solid form. The structure of the deposited pyrocarbon is composed of different components. The depositions are characterised with the principles in use at the IRW and are assigned to the fluidized bed pyrocarbons as far as possible.

18117 **Latest long-term appraisal of U_3O_8 production.** Silve, J.P. (Uranium Pechiney Ugine Kuhlmann, France). pp 19-32 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

Uranium has characteristics similar to other mineral commodities, such as the effect of stockpiles on both short- and long-term markets and the influence that exploration cutbacks have on the long-term balance of supply and demand. A model developed to explore these effects shows a minimum production level to reach market equilibrium, with a regular decrease in inventories, that is below the consumption forecast of US reactors. A downward trend in uranium exploration will likely continue, which will not threaten the supply and demand equilibrium during the next five years. 8 figures.

18118 **Distribution of uranium supply and enrichment.** Bamford, F.W. (British Nuclear Fuels Ltd., London, England). pp 33-42 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

Uranium supply and demand is examined from the perspective of companies in the uranium hexafluoride (UF6) conversion business whose main interest is their sources of uranium supply and UF6 destinations because of transportation costs. Because of the variations in yellowcake transport, charges for conversion, and UF6 transport costs, most converters don't have standard prices. Companies try to look ahead to determine patterns of supplies and delivery points when they analyze the market and estimate future prices. Market analyses must take into account the purchasing policies of utilities around the world. The presentation shows North America supplying about 40% of world uranium, with about 13% of the enrichment done elsewhere. It also shows North American converters getting 53% of the business, but that will require importing uranium from outside North America. 6 tables.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 18111, 18184, 18191, 18825

18119 **(CONF-840112—3) Closing the breeder fuel cycle in the United States.** Burch, W.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007518.

From IEEE Power Engineering Society winter meeting; Dallas, TX, USA (29 Jan 1984).

The status of breeder reprocessing technology and implementation worldwide and the role of the Breeder Reprocessing Engineering Test are discussed.

18120 **(DP-MS—83-143) Savannah River Laboratory data banks for risk assessment.** Durant, W.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 4p. (CONF-840257—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008173.

From DOE nuclear reactor and facility safety conference; Rockville, MD, USA (27 Feb 1984).

The Savannah River Laboratory maintains a series of computerized data banks primarily as an aid in probabilistic risk assessment studies for the Savannah River Plant (SRP) facilities. These include component failure rates, generic incidents, and reports of specific deviations from normal operating conditions. In addition to

providing data for probability studies, these banks have served as a valuable aid in trend analyses, equipment histories, process hazards analyses, consequence assessments, incident audits, process problem solving, and training.

18121 **(KFK—3460) Separation of actinides and fission products from carbonate containing streams.** Haag, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). Apr 1983. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750734.

The capacities of the anion exchange resins AG 1-X8, AG 2-X8 and Bio-Rex 5 were determined for the carbonato complexes of UO_2^{2+}, NpO_2^{2+}, PuO_2^{2+}, Pu^{4+}, AmO_2^{2+} and Am^{3+} in batch and dynamic experiments. The Bio-Rex 5 resin, used for the first time in such experiments, shows a clear superiority over the strong basic resins which have been used in the treatment of uranium ores. The influence of the ratio $U:CO_3^{2-}$, the pH-value, the temperature, the equilibration of the resin, the contact time and the concentration of uranium to the column parameters distribution coefficient, hold back- and break through capacities have been investigated for batch and dynamic experiments. The best results were obtained for a medium with pH 6-8 and low concentrations of actinides and carbonate ions, 0.04 M and 0.12 M respectively. In order to obtain informaiton on the behaviour of the fission products occuring in the recovery of the organic phase of the Purex-process, these expected fission products were added to the uranium solution, fixed and eluted together with the uranium and Bio-Rex 5.

18122 **(KFK—3517) Kinetic investigations on the electrochemical reduction and oxidation processes of plutonium and hydrazine in the Purex-rocess for processing of spent fuels.** Heilgeist, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung; Heidelberg Univ. (Germany, F.R.); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie). Apr 1983. 154p. (In German). (PWA—15/83). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750743.

This treatise deals with the valence-adjustment of plutonium in aqueous nitric acid by electrolytic means. The investigations cover the cathodic reduction for the production of Pu(III) from nitric acid solutions containing Pu(IV) and hydrazine as stabilizer as well as the anodic oxidation of hydrazine and Pu(III) for the production of hydrazine-free Pu(IV)-solutions. In the course of the investigations on the cathodic reduction of Pu(IV) it was noticed, that reduction of Pu(IV) by hydrazine was accelerated by a catalyst. The catalyst was found to be platinum, a small portion of which dissolves, under anodic conditions, from the platinum anode and deposits on the titanium-cathode. The velocity constant was found to be increasing with the density of the electrode area. The temperature dependence of the catalyzed as well as of the noncatalyzed reaction was investigated in the range between 15 and 60°C and the activation energies were calculated. A comparison of the various ammonia production rates under different conditions of the Pu(III)-production shows that, under electrolytic conditions, the ammonia production which occurs during the Pu(IV)-reduction by hydrazine is superposed by the cathodic reduction of nitric acid to ammonia. The velocity of the anodic oxidation of Pu(III) is determined by the nitric acid concentration and the anodic current density.

18123 **(ORO—843) Consolidated Fuel Reprocessing Program. National Program Plan FY 1984.** (USDOE Oak Ridge Operations Office, TN). 1984. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007373.

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This FY 1984 National Program Plan for the Consolidated Fuel Reprocessing Program (CFRP) provides specific guidance from the Department of Energy (DOE) for FY 1984 CFRP activities and a baseline for activities in future years. This is the second issue of the Plan, which is updated anually and summarizes program objectives, summary plans and schedules, budget allocations, contractor involvement, and interfaces with other research programs. The National Program Plan is a controlling document for the Technical Program Plan, which is prepared annually by the CFRP at Oak Ridge National Laboratory (ORNL) and is one of the hierarchical group of planning documents. The CFRP is a part of the DOE's program of research and development (R and D) on nuclear fission systems and is directed by the LMFBR Fuel Cycle Projects Division, Office of Spent Fuel Management and Reprocessing Systems at DOE-Headquarters through the Oak Ridge Operations Office (ORO). The strategy of the program is to maintain the capability to commit to a breeder option through a strong R and D program on breeder reprocessing and alternate fuels and fuel cycles in order to achieve operating and economic advantages.

18124 **(PNL—4976) Criticality experiments with low enriched UO_2 fuel rods in water containing dissolved gadolinium.** Bierman, S.R.; Murphy, E.S.; Clayton, E.D.; Keay, R.T. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 272p. NTIS, PC A12/MF A01. Order Number DE84007968.

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The results obtained in a criticality experiments program performed for British Nuclear Fuels, Ltd. (BNFL) under contract with the United States Department of Energy (USDOE) are presented in this report along with a complete description of the experiments. The experiments involved low enriched UO_2 and PuO_2-UO_2 fuel rods in water containing dissolved gadolinium, and are in direct support of BNFL plans to use soluble compounds of the neutron poison gadolinium as a primary criticality safeguard in the reprocessing of low enriched nuclear fuels. The experiments were designed primarily to provide data for validating a calculation method being developed for BNFL design and safety assessments, and to obtain data for the use of gadolinium as a neutron poison in nuclear chemical plant operations - particularly fuel dissolution. The experiments program covers a wide range of neutron moderation (near optimum to very under-moderated) and a wide range of gadolinium concentration (zero to about 2.5 g Gd/l). The measurements provide critical and subcritical k/sub eff/ data ($1 \geqq$ k/sub eff/ $\geqq 0.87$) on fuel-water assemblies of UO_2 rods at two enrichments (2.35 wt % and 4.31 wt % ^{235}U) and on mixed fuel-water assemblies of UO_2 and PuO_2-UO_2 rods containing 4.31 wt % ^{235}U and 2 wt % PuO_2 in natural UO_2 respectively. Critical size of the lattices was determined with water containing no gadolinium and with water containing dissolved gadolinium nitrate. Pulsed neutron source measurements were performed to determine subcritical k/sub eff/ values as additional amounts of gadolinium were successively dissolved in the water of each critical assembly. Fission rate measurements in ^{235}U using solid state track recorders were made in each of the three unpoisoned critical assemblies, and in the near-optimum moderated and the close-packed poisoned assemblies of this fuel.

18125 **(ZfK—495) Theoretical and experimental fundamentals of the test-sieving and investigations of the sieving properties of UO_2-powder.** Stolle, W.; Henke, M. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1983. 24p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700090.

The results of sieve analyses may be interpreted in the best manner by approximate functions which permit the exact description of the grain size distributions by two parameters. This fact facilitates the comparison of results of size analyses essentially and enables their graphical representation in form of linear size-distributions curves. The deviations of the linearity refer to irregularities in the powder preparation or in the powder processing. Investigations of UO_2-powders by dry sieve analysis have shown that it is possible to classify such powders in the range of grain sizes of more than 63 micrometers, in which specific sieving conditions must be find out for each special material.

18126 **Accuracy for plutonium assay using a lead slowing down spectrometer.** Alam, B.; Block, R.C.; Harris, D.R.; Vanterpool, E.C.; Wilkinson, J.W. (Renssalaer Polytechnic Institute, Troy, NY 12181). *Transactions of the American Nuclear Society;* **45**: 136-137(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18127 **Status of spent-fuel storage and reprocessing in the United States.** Laughon, K.O.; Klein, K.A. (Dept. of Energy, Washington, DC). pp 72-82 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

A review of administration views on the post-reactor nuclear-fuel cycle begins with general goals of US nuclear programs, then focuses on the status of near-term options for managing spent fuel now accumulating at reactor sites, and the status of efforts to reinstate commercial reprocessing in the US. Reagan favors reprocessing by the private sector, and is working to reduce the uncertainties and risks. He is committed to re-establishing the US as a predictable and reliable supplier of fuel-cycle services, including reprocessing, which can solve the problem of spent-fuel accumulation. The administration is confident that no utility will be forced to shut down as a result of the spent-fuel accumulation problem beyond current storage capabilities. Other options are being developed in the event reprocessing does not occur soon enough.

18128 **Technical and commercial development of reprocessing services.** Salmon, A. pp 83-97 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

A review of the technical and commercial developments in the nuclear fuel cycle over the past 30 years shows that processes exist which serve the present needs of the industry. The contractual arrangements are somewhat unusual, partly because the capital involved is large and the products are extraordinary. The technical processes, based on many years of experience of reprocessing, have reached a stage where further development is unlikely to be, and indeed, does not need to be rapid. The prime requirement is a progressive development of the industry so that designs, developments, and operating experience can be built up steadily to meet the increasing demands for reprocessing capacity in the future. 6 references, 4 tables.

18129 **Reprocessing or storage - a utility perspective.** Pauluis, G. (SYNATOM, S.A., Brussels, Belgium). pp 98-111 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

The Belgian utilities are reprocessing their fuel rather than storing it for an indefinite period of time in a central facility, although this does not preclude their use of very large capacity storage pools on site. New power plants have about a 10-year buffer capacity. An explanation of the reasons behind this strategy attempts to discriminate between their general or local applicability. A summary of day-to-day experience in reprocessing, as seen by customers of the service, shows that institutional delays in the return of the fissile materials continues to cause some concern even though reprocessing is now technically well under control. SYNATOM, the single subsidiary managing the nuclear fuel cycle, has split the commercial risk by contracting about 40% of its needs abroad to COGEMA, and simultaneously directing studies to take full advantage of an existing reprocessing facility in Belgium. 4 figures.

18130 **ENEL's experience on plutonium recycle in LWR.** Cuzzaniti, M. pp 112-118 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

Italy's Ente Nazionale Per l'Energia Ellettrica (ENEL) was faced with the possibility of plutonium recycle in thermal reactors earlier than other electric utilities because it operated a graphite-Magnox station at Latina with a high plutonium production and two light water stations (Garigliano and Trino Vercellese) in which plutonium might be recycled. This paper describes the experience with plutonium fuel at the two stations and studies done in collaboration with EURATOM on the control and safety of plutonium-fueled light-water reactors. The validity of the recycle was found to be closely dependent on economic conditions, including the fabrication overprice applied by the manufacturers and the particular financial criteria adopted by the operator in evaluating the fuel cycles. Despite excellent technical results, ENEL has suspended reprocessing mixed-oxide fuels activity for economic reasons, and has used all plutonium produced from the reprocessing of irradiated fuel for the fabrication of the initial core of Superphenix. 1 table.

18131 **Technical and economic aspects of plutonium recycling.** Beer, O.; Schmiedel, P.; Riedel, E. pp 119-149 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

Light water reactors (LWRs) with fuel assemblies containing enriched uranium operate with a high degree of reliability. A characteristic of uranium fuel assemblies is that during burnup a considerable plutonium content arises in the fuel and becomes greater as burnup increases so that second-order effects must be taken into account. From this point of view, plutonium recycling does not pose any new problems, only those of quantity. The paper describes mixed-oxide fuel (MOX) assemblies, the manufacturing technology involved and the characteristics of multiple recycling. The economics of reprocessing is based on resource conservation, economic, ecological, and political influences rather than a justification for spent-fuel disposal. The paper concludes that plutonium's highest value in the long run lies with fast breeder reactors. Until they are available in sufficient numbers, resource savings will be moderate. 21 figures.

18132 **Political influences in plutonium recycling.** Patak, H.N. (Electrizitats-Gesellschaft Laufenburg, Switzerland). pp 150-158 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

The history of plutonium safeguards is one of political error and misunderstandings, as well as a lack of technical knowledge. Although there was widespread support for preventing the proliferation of nuclear explosives, with over 100 nations signing the Nonproliferation Treaty of 1969, India's 1974 nuclear test brought renewed political activity to prevent another such occurrence. Opposition has been directed only at how to pursue this goal, but the status of four major experiments aimed at minimizing weapons proliferation is one of failure, intensified by a weakening of the International Atomic Energy Agency (IAEA). If the link between plutonium power and weapons production can be broken through on-site reprocessing, the situation could improve. One course would be for the nuclear power industry to adopt its own system for safe guarding plutonium. (DCK)

0509 Transport And Storage

REFER ALSO TO CITATION(S) 18160, 18171, 18194, 18195, 18208, 18264, 18908, 18909

18133 **(SAND—83-2550C) TRUPACT-I: a contact-handled transuranic waste transportation system.** Romesberg, L.E.; Wowak, W.E.; Johanson, N.W.; Grenier, R.M. (Sandia National Labs., Albuquerque, NM (USA); GA Technologies, Inc., San Diego, CA (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840307—11). NTIS, PC A02; 3; GPO Dep. Order Number DE84008332.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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In the late 1970's, the Department of Energy (DOE) initiated a program to develop an efficient, safe, reliable and cost effective transportation system for the carriage of contact-handled transuranic waste within the DOE complex. The system developed (TRUPACT-I) consists of two major assemblies: the containment system and the outer protective structure. The containment system prevents the release of TRU nuclides in excess of regulatory limits. The outer protective structure protects against the structural and thermal loadings imposed during normal and accident conditions. A fully-loaded truck version of TRUPACT-I will weight 22.7 tonnes (50,000 lbs) and has a payload of 7.7 tonnes (17,000 lb). TRUPACT-I has been designed to accommodate a variety of material handling equipment such as lift trucks, powered roller conveyors and possibly air pallet systems. The prototype will be fabricated and tested during late FY 84. A three unit minifleet will be operated during FY 85 and FY 86 to gain operational experience. 2 references, 3 figures, 2 tables.

18134 **(SAND—84-0516C) Evaluation of thermal and structural computer codes.** Trujillo, A.A.; Nelsen, J.M.; Gwinn, K.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-840307—17). NTIS, PC A02; 3; GPO Dep. Order Number DE84009068.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Paper copy only, copy does not permit microfiche production.

A large number of thermal and structural codes exist which could be applied to the design and licensing of spent fuel shipping casks. This paper describes a program whose purpose was to provide information to designers that would aid them in making decisions regarding the selection of the most appropriate thermal or structural code for their particular design. The program was conducted in four phases: (1) Code inventory and evaluation, (2) model problem development, (3) model problem solution, and (4) information exchange meeting. The current status of the program as well as its future direction is discussed. 2 references, 2 figures, 3 tables.

18135 **(SAND—84-0571C) Transportation research activities in support of nuclear waste management programs.** Jefferson, R.M.; Allen, G.C.; Cashwell, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 5p. (CONF-840307—15). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009094.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

While the technology to transport nuclear wastes is generally viewed to be available, research and development activities in support of nuclear waste management programs are still expected to be required. The status of current base technology activities at the Transportation Technology Center (TTC) and their direction for the future are reviewed in this paper. These activities include tasks in standards and subsystems development, systems technology development, information materials and systems, institutional issue analyses and safety analyses.

18136 **(UNI—2758) FY83 fuel storage basins surveillance and maintenance status report.** (UNC Nuclear Industries, Inc., Richland, WA (USA)). 31 Jan 1984. Contract AC06-76RL01857. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008168.

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An informational update is provided on the FY83 irradiated fuel storage basins surveillance and maintenance activities and achievements. Section 2.0 provides information about the surveillance, and Section 3.0 the maintenance activities. Figures and Tables are presented to provide a quick overview of the changes observed within various parameters monitored. For a brief period in July the Cs-137 concentration in the KW basin went above Table II limits. This increase was not significant and no environmental impact or public health hazard resulted. Crane problems caused some minor delays in fuel shipments, but did not seriously impact the overall fuel shipment schedule. Several basin modification projects were initiated. One of these projects, the KE basin chiller, began successful operation near the end of the fiscal year.

18137 **Department of Energy dry storage research and development programs.** Scheider, S.P. (U.S. Department of Energy, Washington, DC 20545). *Transactions of the American Nuclear Society;* **45**: 81(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18138 **Experimental studies of rapidly oxidizing Zircaloy cladding bundles in air.** Stalker, K.T.; Benjamin, A.S. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **45**: 134-135(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18139 **The propagation of self-sustaining zirconium oxidation in a drained spent fuel storage pool.** Best, F.; Pisano, N. (Texas A & M University, College Station, TX 77843). *Transactions of the American Nuclear Society;* **45**: 133-134(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18140 **Wet pool independent spent fuel storage installation.** Dobson, W.L. (Gilbert Commonwealth, P.O. Box 1498, Reading, PA 19603). *Transactions of the American Nuclear Society;* **45**: 119(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18141 **Spent fuel shipping costs for transportation logistics analysis.** Cole, B.M.; Chaswell, J.W.; Cross, R.E.; McNair, G.W.; Votaw, E.F. (Battelle-Pacific Northwest Lab., P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 118-119(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18142 **Methodology for computing limiting temperature to control UO_2 oxidation.** Gilbert, E.R.; Guenther, R.J.; White, G.D.; Wildung, N.J. (Battelle Pacific Northwest Lab., P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 86-87(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18143 **Requirements for acceptable spent fuel integrity during dry storage.** Cantley, D.A.; Einziger, R.E. (Westinghouse Hanford Company, P.O. Box 1970, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 85(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18144 **German experience in cask storage of spent fuel.** Rollins, J.D.; Baatz, H. (GNS/USA, 30 Six Branches Court, Roswell, GA 30076). *Transactions of the American Nuclear Society;* **45**: 85(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18145 **Technical basis and economics for monitored retrieval storage.** Duffy, L.P. (Westinghouse Electric Corporation, P.O. Box 2728, Pittsburgh, PA 07446). *Transactions of the American Nuclear Society;* **45**: 81-84(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18146 **(RISLEY-Trans—4828) Installation and method for the storage of spent fuel elements.** Queiser, H.; Eckhardt, B. (UKAEA Risley Nuclear Power Development Establishment; Kraftwerk Union A.G., Muelheim an der Ruhr (Germany, F.R.)). 7 Sep 1983. C; German Patent 0,031,048. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900808.

The invention relates to an installation and method for the storage of spent fuel elements from a nuclear reactor using a fuel element transport flask with an internal cavity for receiving at least one fuel element and a cover for the gas-tight closure of an opening leading into the internal cavity. During such storage it must be assumed that the gas-tight closure remains reliably effective even during long-term storage, lasting several years, for example, because otherwise radioactivity could be carried out. The latter must, however, be avoided especially when the residual heat still being emitted by the spent fuel elements is dissipated to the atmosphere by air cooling. The invention, therefore, aims at a method for the simple but nevertheless reliable monitoring of leak-tightness.

18147 **(RISLEY-Trans—4795) Combined transport and storage system for fuel elements extending in the longitudinal direction.** Neumann, E. (UKAEA Risley Nuclear Power Development Establishment; Brown Boveri Reaktor G.m.b.H., Mannheim (Germany, F.R.)). 23 Aug 1983. C; German Patent 28,17,545. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900805.

The invention concerns a combined transport and storage system for fuel elements extending in the longitudinal direction which are stored inside or outside nuclear power stations or reprocessing factories, whereby transport to and from the stores takes place in sealed transport flasks provided with built-in support frames and whereby the fuel elements are placed in racks for storage. Transport of fuel elements is taking place to an increasing extent between fabrication factories for new fuel elements, nuclear power stations, interim or final storage and reprocessing factories for spent fuel elements.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 18111, 18112, 18113, 18117, 18118, 18145, 18195, 18219, 18220, 18221, 18224, 18233

18148 **Overview of factors influencing the secondary market.** Bleistine, P.A. pp 43-49 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

The major factor influencing secondary trading for the last few years has been the large contractural commitments built up by consumers for reactor programs which have proven to be unrealistic. The situation has intensified as a result of utilities needing to generate capital through inventory liquidation or reductions. The flexibilities in most contracts are inadequate to match the types of external and/or internal factors faced by the industry. This situation also suggests the need for secondary markets to help the industry adjust to unforeseen difficulties. They are very active markets at this time, but their influence in relation to the long-term method of doing business should not be exaggerated.

18149 **Secondary SWU market - the changing circumstance.** Wolf, W.H. pp 50-56 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp. (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

The author gives historical background on the uranium enrichment services (SWU) market before evaluating where the market currently stands and where it may be going, particularly in light of the new DOE Facility Requirement (FR) contract. The SWU market came into being as the most economic alternative available to a holder of excess SWU commitments. The FR contract will probably lead to three levels of marketplace activity: material for use within FR contracts from existing DOE inventories; shuffle transactions involving DOE source SWUs to be placed into remaining adjustable, fixed-commitment contracts; and non-DOE origin SWU and worldwide inventory and excess commitments. He concludes that the amount of transactions involving DOE SWU commitments will continue to dwindle, particularly as DOE becomes more and more of a marginal supplier in the overseas market. An appendix summarizes DOE fixed-commitment contract assignments.

18150 **Spot market for uranium.** Colhoun, C. pp 57-71 of World nuclear fuel market: proceedings of the international conference on nuclear energy. Atlanta, GA; Nuclear Assurance Corp., 24 Executive Park West, Atlanta, GA 30329 (1982). (CONF-8210237—).

From 9. international conference on nuclear energy - world nuclear fuel market; Nice, France (17 Oct 1982).

The spot market is always quoted for the price of uranium because little information is available about long-term contracts. A review of the development of spot market prices shows the same price curve swings that occur with all raw materials. Future long-term contracts will probably be lower to reflect spot market prices, which are currently in the real-value range of $30-$35. An upswing in the price of uranium could come in the next few months as utilities begin making purchases and trading from stockpiles. The US, unlike Europe and Japan, has already reached a supply and demand point where the spot market share is increasing. Forecasters cannot project the market price, they can only predict the presence of an oscillating spot or a secondary market. 5 figures.

0520 Waste Management

REFER ALSO TO CITATION(S) 18121, 18127, 18250, 18251, 18254, 18255, 18256, 18257, 18258, 18264, 18766, 18906, 19114, 19117, 19222, 19223, 19229

18151 **(ANL/EES-TM—242) Radioactive waste isolation in salt: peer review of the Office of Nuclear Waste Isolation's Geochemical Program Plan.** Harrison, W.; Seitz, M.; Fenster, D.; Lerman, A.; Brookins, D.; Tisue, M. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 28p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009079.

Describe the management program for coordinating subcontractors and their work, and integrating research results. Appropriate flowcharts should be included. Provide more information on the overall scope of the program. For each subcontractor, provide specific workscopes that indicate whether analytical activities are developmental or routine, approximate number of analyses to be made, and something of the adequacy of the analyses to meet program goals. Indicate interfaces with other earth-science disciplines like hydrology and with other groups doing relevant geochemical research and engineering design. Address the priorities for each activity or group of activities. High priority should be given to early development of a geochemical statement of what constitutes suitable salt for a repository. Reference standard procedures for sampling, sample preservation, and sample analysis wherever appropriate or, if not appropriate, indicate that any deviations from standard procedures will be documented. Ensure that appropriate quality assurance procedures will be followed for the procedures listed above. Include specific procedures for the choice, verification, validation, and documentation of computer codes related to the geochemical aspects of repository performance assessment. Include activities addressing regional hydrochemistry and make clear that each principal hydrogeologic unit at each site will be studied geochemically. Indicate that proposed plans for obtaining hydrogeochemical data will be included in each site characterization plan. Describe how site geochemical stability will be handled, especially with respect to dissolution, postemplacement geochemistry, human influences, and climatic variations. Minor recommendations and suggested improvements in the text of the plan are given in Sec. 5.

18152 **(ANL/EES-TM—243) Radioactive waste isolation in salt: peer review of Office of Nuclear Waste Isolation's Socioeconomic Program Plan.** Winter, R.; Fenster, D.; O'Hare, M.; Zillman, D.; Harrison, W.; Tisue, M. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 50p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009388.

The ONWI Socioeconomic Program Plan spells out DOE's approach to analyzing the socioeconomic impacts from siting, constructing, and operating radioactive waste repositories and discusses mitigation strategies. The peer review indicated the following modifications should be made to the Plan: encourage active public participation in the decision-making processes leading to repository site selection; clearly define mechanisms for incorporating the concerns of local residents, state and local governments, and other potentially interested parties into the early stages of the site selection process; place significantly greater emphasis on using primary socioeconomic data during the site selection process, reversing the current overemphasis on secondary data collection, description of socioeconomic conditions at potential locations, and development of analytical methodologies; recognize that mitigation mechanisms other than compensation and incentives may be effective; as soon as potential sites are identified, the US Department of Energy (DOE) should begin discussing impact mitigation agreements with local officials and other interested parties; and comply fully with the pertinent provisions of NWPA.

18153 **(BMI—1983-003) Origin, handling and storage of tritium.** Lorscheider, R.; Kayser, W. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Sep 1983. 245p. (In German). (NUKEM—500). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84750751.

The origin, handling and intermediate and/or final storage of tritium in the Federal Republic of Germany are described and evaluated. For this the following subjects - use, amounts of waste and emission, waste handling, transport, legal situation and points relevant to safety in respect to tritium handling, general valuation and future development - are completely presented. Presently and in future the waste volume will be determined by the fact that nearly the whole amount of tritium waste activity is contained in a small part of the overall waste volume. The rest is distributed to a relatively big waste volume accordingly showing low activity concentration levels. Future efforts are mainly necessary in respect to the handling of tritium waste.

18154 **(BMI/ONWI—526) Winter sound-level characterization of the Deaf Smith County location in the Palo Duro Basin, Texas.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1984. Contract AC02-83CH10140. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009958.

A description of sound levels and sound sources in the Deaf Smith County location in the Palo Duro Basin during a period representative of the winter season is presented. Data were collected during the period February 26 through March 1, 1983. 4 references, 1 figure, 3 tables.

18155 **(BMI/ONWI—528) Summer sound-level characterization of the Deaf Smith County and Swisher County locations in the Palo Duro Basin, Texas.** (NUS Corp., Gaithersburg, MD (USA)). Mar 1984. Contract AC02-83CH10140. 40p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009957.

A description of sound levels and sound sources in the Deaf Smith County and Swisher County locations in the Palo Duro Basin during a period representative of the summer season is presented. Included are data collected during the period August 4 through 8, 1982, for both locations. 3 references, 2 figures, 3 tables.

18156 **(CONF-831217—26) Socioeconomic assessment: issues, status, and plans.** Boryczka, M.K. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1983. Contract AC02-83CH10140. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84005294.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

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Numerous public meetings and hearings have been held in Texas, Mississippi, Louisiana and Utah on the issue of siting a nuclear waste repository in salt. Citizens in these potential site areas have raised many questions about how this facility will affect their quality of life. Questions about population and economic changes have been of particular concern. In developing a socioeconomic program, these issues and others have been an integral part of Battelle's socioeconomic studies. The three elements of Battelle's socioeconomic program are comprised of three elements: impact assessment, impact mitigation and community development, and impact monitoring. In addition, our approach to assessing socioeconomic impacts for the environmental assessment (EA) required by the Nuclear Waste Policy Act of 1982 are described. Since the EA analysis will address many of the issues raised in the site areas, these concerns will be elaborated on. Finally, various techniques for managing socioeconomic impacts will be presented. 6 references, 1 figure.

18157 **(CONF-831217—27) Definition of the waste package environment for a repository located in salt.** Clark, D.E.; Bradley, D.J. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Battelle Pacific Northwest Labs., Richland, WA (USA)). 1983. Contract AC02-83CH10140. 6p. NTIS, PC A02; 3; GPO Dep. Order Number DE84005295.

From 5. civilian radioactive waste management information meeting; Washington, DC, USA (12 Dec 1983).

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The expected environmental conditions for emplaced waste packages in a salt repository are simulated in the materials testing program to evaluate performance. Synthetic brines, based on the analyses of actual brines (both intrusion and inclusion), are used for corrosion and leach testing. Elevated temperatures (to 150°C) and radiation fields of up to 10^3 rad/h are employed as conservative conditions to bracket expected performance and provide data for worst case scenarios. Obtaining a precise definition of the waste package environment in a salt repository and its change with time is closely tied to detailed site characterization of the candidate salt repository horizon. It is expected that field testing can augment some of the materials testing currently under way and can provide increased confidence in the predicted site-specific near-field conditions. 17 references, 5 figures, 1 table.

18158 **(CONF-840245—8) Statewide screening for low-level radioactive waste shallow land burial sites.** Staub, W.P.; Cannon, J.B.; Stratton, L.E. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007522.

From 6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste; Fort Collins, CO, USA (1 Feb 1984).

A methodology was developed for statewide low-level waste site screening based on NRC site selection criteria. The methodology and criteria were tested in Tennessee to determine their effectiveness in narrowing the choice of sites for more intensive localized site screening. The statewide screening methodology entailed two steps. The first step was to select one or more physiographic provinces wherein sites meeting the criteria were most likely to be found. The second step was to select one or more suitable outcrop bands from within the most favorable physiographic provinces. These selections were based entirely on examination of existing literature and maps at scales no larger than 1:250,000. The statewide screening project identified only one suitable physiographic province (the Mississippi Embayment region) and one favorable outcrop band (the Coon Creek Formation) within a three county area of western Tennessee. Ground water monitoring and predictability proved to be the most difficult criterion to meet. This criterion alone eliminated other outcrop bands in the Mississippi Embayment as well as the Eastern Highland Rim and Western Highland Rim physiographic provinces. Other provinces failed to meet several screening criteria. 3 references, 3 figures, 1 table.

18159 **(DOE/LLW—18T-Rev.3) Radioactive waste management: a summary of state laws and administration. Revision 3.** (EG and G Idaho, Inc., Idaho Falls (USA); Inter/Face Associates, Inc., Middletown, CT (USA)). Feb 1984. Contract AC07-76ID01570. 516p. NTIS, PC A22/MF A01; GPO Dep. Order Number DE84007326.

This is the third update of Radioactive Waste Management: A Summary of State Laws and Administration. It completely replaces the second update (15 July 1983). The updated report covers the administration, the legislature and the laws in the 50 states related to radioactive waste. The report for each state is divided into four sections: Cover Page; Administrative; Legislative; and Applicable Legislation. The cover page indicates whether or not it is an Agreement State, the low-level waste compacts in which the state is listed as an eligible state, and the high-level waste repository site screening regions in which the state or a portion of it is located. Included under the compacts is a description of what the state has done or currently plans to do, as well as the compact status of other eligible states in the region. In general, the information in this report is accurate as of January 1, 1984.

18160 **(DOE/NV/10250—13) Commercial nuclear waste research and development program. Quarterly report, October-December 1983.** Hakl, A.R. (Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.). 1 Mar 1984. Contract AC08-82NV10250. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009379.

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Activities performed during the first quarter of Fiscal Year 1984 to meet task objectives of the Nevada Nuclear Waste Storage Investigations FY 1984 Project Plan are reported in this document. Noteworthy accomplishments during this reporting period included: substantial activity was devoted to defining the potential cost advantages to performing the Solicitation for Cooperative Agreement Proposals activities at the E-MAD facility; remote fuel handling operations were performed to acquire gas samples from the canisters containing fuel assemblies D22, B41, and B43; canisterized fuel assembly D22 was installed in Drywell 5 in the E-MAD Drywell Storage Area; design packages were prepared for performing fuel integrity monitoring and calorimeter operations of fuel assemblies; instructions have been drafted for rework of previously used canisters which have been cut open; a Design Review was held for dosimetry of fuel assembly D34 and sectioning of the canister in which it has been stored; an interim development plan was prepared for waste package closure evaluation activities; support being provided to the DOE/NV Quality Assurance Division included drafting of a master Quality Assurance Implementation Plan, a procedure for preparation and control of Quality Assurance Program Plans, and a handbook explaining various quality elements that should be addressed in the Program Plan; and the Fuel Temperature Test, being performed for the DOE Richland Operations Office Commercial Spent Fuel Management Program, is in its tenth month of operation.

18161 **(DP-MS—83-62) Devitrification behavior of SRL defense waste glass.** Bickford, D.F.; Jantzen, C.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1983. Contract AC09-76SR00001. 13p. (CONF-831174—83). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008188.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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Simulated SRL waste was prepared with compositions varying in iron and aluminum content. Two batches with similar composition were produced with different amounts of reducing agent added. Samples were isothermally heat treated and used to derive time-temperature-transformation diagrams. Supplementary samples were cooled in a manner programmed to simulate the cooling curves of production canisters. Less than 10% total devitrification occurs during normal processing. However, when waste glass 165 was purposely devitrified, up to 30 volume percent total spinel and acmite formed. Formation of these species had minor effect on leachability in MCC-1 and accelerated leach tests. 20 references, 4 figures, 2 tables.

18162 **(DP-MS—83-86) Greater confinement disposal program at the Savannah River Plant.** Cook, J.R.; Towler, O.A.; Peterson, D.L.; Johnson, G.M.; Helton, B.D. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1984. Contract AC09-76SR00001. 6p. (CONF-840307—16). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009077.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The first facility to demonstrate Greater Confinement Disposal (GCD) in a humid environment in the United States has been built and is operating at the Savannah River Plant. GCD practices of waste segregation, packaging, emplacement below the root zone, and waste stabilization are being used in the demonstration. Activity concentrations to select wastes for GCD are based on a study of SRP burial records, and are equal to or less than those for Class B waste in 10CFR61. The first disposal units to be constructed are 9-foot diameter, thirty-foot deep boreholes which will be used to dispose of wastes from production reactors, tritiated wastes, and selected wastes from off-site. In 1984 an engineered GCD trench will be constructed for disposal of boxed wastes and large bulky items. 2 figures, 1 table.

18163 **(DP-MS—83-111) Decontamination of DWPF canisters by glass frit blasting.** Ward, C.R.; Rankin, W.N. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 7p. (CONF-840307—12). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008286.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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High-level radioactive waste at the Savannah River Plant will be incorporated in borosilicate glass for permanent disposal. The waste glass will be encapsulated in a 304L stainless steel canister. During the filling operation the outside of the canister will become contaminated. This contamination must be reduced to an accepable level before the canister leaves the Defense Waste Processing Facility (DWPF). Tests with contaminated coupons have demonstrated that this decontamination can be accomplished by blasting the surface with glass frit. The contaminated glass frit byproduct of this operation is used as a feedstock for the waste glass process, so no secondary waste is created. Three blasting techniques, using glass frit as the blasting medium, were evaluated. Air-injected slurry blasting was the most promising and was chosen for further development. The optimum parametric values for this process were determined in tests using coupon weight loss as the output parameter. 1 reference, 13 figures, 3 tables.

18164 **(DP-MS—84-8) Performance of a large-scale melter off-gas system utilizing simulated SRP DWPF waste.** Kessler, J.L.; Randall, C.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Mar 1984. Contract AC09-76SR00001. 7p. (CONF-840307—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008178.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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The Department of Energy and the DuPont Company have begun construction of a Defense Waste Processing Facility to immobilize radioactive waste now stored as liquids at the Department of Energy's Savannah River Plant. The immobilization process solidifies waste sludge by vitrification into a leach-resistant borosilicate glass. Development of the process has been the responsibility of the Savannah River Laboratory. As part of the development, two large-scale glass melter systems have been designed and operated with simulated waste. Experimental data from these operations show that process requirements will be met. 6 references, 8 figures, 4 tables.

18165 **(DP-MS—84-11) In-tank precipitation process for decontamination of water soluble radioactive waste.** Martin, H.D.; Schmitz, M.A.; Ebra, M.A.; Walker, D.D.; Kilpatrick, L.L.; Lee, L.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 6p. (CONF-840307—19). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009073.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

A precipitation and adsorption process has been developed to remove cesium, strontium, and plutonium from water-soluble, high-level radioactive waste. Sodium tetraphenylborate precipitates cesium and sodium titanate adsorbs strontium and plutonium. The solids are separated from the decontaminated salt solution by cross-flow filtration. This new process offers significant capital savings over an earlier ion exchange process for salt decontamination. Chemical and engineering studies with actual and simulated waste are reported. The effect of many variables on the decontamination factors and filter performance are defined. 3 references, 5 figures, 3 tables.

18166 **(DP-MS—84-19) Defense waste processing facility project at the Savannah River Plant.** Baxter, R.G.; Maher, R.; Mellen, J.B.; Shafranek, L.F.; Stevens, W.R. III. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 5p. (CONF-840307—18). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009076.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The Du Pont Company is building for the Department of Energy a facility to vitrify high-level waste at the Savannah River Plant near Aiken, South Carolina. The Defense Waste Processing Facility (DWPF) will solidify existing and future radioactive wastes produced by defense activities at the site. At the present time engineering and design are 45% complete, the site has been cleared, and startup is expected in 1989. This paper will describe project status as well as features of the design. 9 figures.

18167 **(DPST—83-288) Evaluation of water and abrasive blasting techniques for canister decontamination-radioactive tests.** Rankin, W.N.; Ward, C.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 2 Feb 1983. Contract AC09-76SR00001. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008291.

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Abrasive blasting techniques are being developed for canister decontamination. Abrasive blasting with a slurry of frit followed by rinsing with high pressure water is the present reference process. The present reference process was reevaluated, because of equipment design concerns due to the abrasiveness of the slurry, and potential corrosion problems due to possible water intrusion into the canister. The ability of candidate processes to remove radioactive contamination from Type 304L stainless steel specimens has now been quantitatively determined under DWPF conditions. The type of contamination, the amount of contamination, and the heating conditions used spanned the range of conditions expected in the DWPF.

18168 **(EGG-M—12283) Low level power plant cement solidified waste leaching study.** Croney, S.T.; Young, T.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 3p. (CONF-831047—140). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008022.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

Leaching results of small laboratory-sized cement samples can be used to predict full-scale waste form behavior using a semi-infinite plane diffusion model within the limits where sample depletion has not occurred. To predict long-term releases from large samples, a finite diffusion model must be used. The semi-infinite model overpredicts releases of a 210-liter-sized cylinder beyond 20% removal. Leaching of waste must continue long enough to ensure that the diffusion coefficient determined is the predominant one. Two distinct diffusion coefficients may exist as in the case of cobalt in the first mix samples, where the initial high release did not represent the major release. For the two different waste mixes studied here, cesium showed a 39% difference in the diffusion coefficient and the first mix had a small fraction of highly mobile cobalt not seen in the second mix. Mix procedures were the same for both waste samples indicating that the variability in the waste forms is due to differences in the waste liquid.

18169 **(Juel-Spez—148) Development of a high-temperature furnace for a thermogravimetry-mass spectrometry system.** Molitor, K.; Jagdfeld, H.J.; Odoj, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). May 1982. 65p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750516.

In thermogravimetric analysis, the homogeneous distribution of temperature in the samples plays a decisive role with regard to the accuracy of the measured results. This can be achieved relatively easy by a heating furnace designed as large as possible. For the intended coupling of a thermo balance with a mass spectrometer a large furnace is unfavourable because the distance between sample and mass spectrometer is also larger. Since the number of molecules evaporating from the sample decreases with the square of distance, the distance should be small. Thus a high-temperature ($<=1300°C$) furnace as small as possible is needed, with homogeneous temperature distribution in the sample. In addition, the gaz has to be let in via a 2-step screen system for pressure reduction. To avoid condensation of vapour phase, the screens should be heated up to sample temperature. For the development of such a furnace the following parameters were investigated: Height of furnace, effect of stack, insulation, "inner" furnace and radiation screens, diameter of the heating wire, heating conductor, sucking effect, shape of screens, and cross-section of flange.

18170 **(Juel-Spez—201) Classification of radioactive waste and determination of waste specifications as well as conditions of acceptance for ultimate storage.** Merz, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Apr 1983. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750510.

The determination of waste specifications and conditions of acceptance must follow a certain scheme, the basics of which will be presented. First the types of waste and the ultimate storage facilities will be characterized. The various categories of waste will be listed in a universally valid system, and the preliminary conditioning options will be determined. Based on the results of safety analysis taking into account the whole system - geological circumstances, ultimate store mines, types and forms of waste - specifications for the various ultimate storage products are to be derived following iterative methods. Suggestions though not of a binding nature and probably subject to eventual revisions in part will be presented. To ensure the safety goals, i.e. the exclusion of radioactivity from the human biosphere, appropriate quality control is required concerning the production and the acceptance at the ultimate store. The guiding principles to be heeded will be discussed in brief.

18171 **(KEH/R—83-96) Monitored Retrievable Storage conceptual system study: dry receiving and handling facility.** (Raymond Kaiser Engineers, Inc., Oakland, CA (USA)). Jan 1984. Contract AC06-82RL10367. 167p. NTIS, PC A08; 3; GPO Dep. Order Number DE84009310.

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A preconceptual design and estimate for a MRS receiving and handling (R and H) facility at a hypothetical site in the United States are presented. The facility consists of a receiving and handling building plus associated operating buildings, system, and site development features. The R and H building and the supporting buildings and site development features are referred to as the R and H area. Adjoining the R and H area will be an interim waste storage area currently being considered by others. The desirability of building a full capacity (3000-MTU) MRS facility initially versus adding additional capacity at a later date in a phased construction program was investigated. Several advantages of phased construction include incorporation of new designs, modification of receiving-handling-packaging, and changes in regulatory requirements or

the waste management program which may develop following startup and operation of an 1800-MTU MRS facility. The cost of a 3000-MTU MRS facility constructed initially was estimated at $193,200,000. If a phased construction program was implemented, including escalation to the mid-point of Phase 2 construction, a capital expenditure of $215,300,000 is estimated - a cost penalty of $22,100,000 or about 11% for phased construction.

18172 **(LA—9846-PR) Research and development related to the Nevada Nuclear Waste Storage Investigations. Quarterly progress report, April 1-June 30, 1983.** Ogard, A.E.; Wolfsberg, K.; Vaniman, D.T. (comps.). (Los Alamos National Lab., NM (USA)). Dec 1983. Contract W-7405-ENG-36. 107p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84007991.

This report summarizes the contribution of the Los Alamos National Laboratory to the Nevada Nuclear Waste Storage Investigations for the third quarter of 1983. The status of the following studies is reported: geochemistry of tuff; mineralogy-petrology of tuff; rock physics; shaft and borehole sealing; exploratory shaft; and volcanism investigations. 45 references, 7 figures, 21 tables.

18173 **(LA-UR—84-200) Electron accelerator based system for assay of transuranic waste barrels.** Kocimski, S.M.; Franks, L.A.; Caldwell, J.T.; Close, D.A.; Kunz, W.E.; Morgado, R.E.; Bieri, J.M. (Los Alamos National Lab., NM (USA); EG and G, Inc., Goleta, CA (USA)). 1984. Contract W-7405-ENG-36. 31p. (CONF-840529—2; EGG—10282-2015). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84006023.

From Linear accelerator conference; Darmstadt-Seeheim, F.R. Germany (7 May 1984).

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A complete assay system for 208-liter barrels contianing transuranic wastes has been developed. The system consists of an 8-MeV commercial electron accelerator, neutron moderating cavity housing the waste barrel and containing neutron detectors, high resolution germanium gamma spectrometer, and x-ray radiography camera (both film and real time). The electron linac is used to produce bremsstrahlung and high-intensity pulsed neutron flux, both of which are used to interrogate the fissionable materials. The Differential Dieaway Technique is used to assay the amounts of fissile and fertile materials. The neutron flux is also used in the Prompt Gamma Activation Assay to determine and to quantify the matrix elements present in the barrels. This information is then used to correct the assay of fissionable material. The bremsstrahlung too, is also used by x-ray radiography system to further identify the matrix.

18174 (NUREG/CP—0041-Vol.3, pp 60-62) **Independent spent fuel storage installation task analysis.** Bateman, R.P.; Hottman, S.B.; Biers, D.W. (Systems Research Labs., Inc., Dayton, OH). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This report presents the results of a task analysis and recommendations for the training and certification of operations technicians at independent spent fuel storage installations. Its purpose is to provide a technical basis for initial and continuation training for operations technicians at Independent Spent Fuel Storage Installations (ISFSI). It also provides guidance for testing operations technicians to ensure that training objectives have been achieved. The recommended testing provides a basis for certification of ISFSI operators.

18175 **(NUREG/CR—3091-Vol.3) Review of waste package verification tests. Semiannual report, April-September 1983. Volume 3.** Soo, P. (ed.). (Brookhaven National Lab., Upton, NY (USA)). Feb 1984. Contract AC02-76CH00016. 165p. (BNL-NUREG—51630-Vol.3). NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84007883.

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The current study is part of an ongoing task to specify tests that may be used to verify that engineered waste package/repository systems comply with NRC radionuclide containment and controlled release performance objectives. Work covered in this report analyzes verification tests for carbon steel container corrosion and the testing methodologies that are appropriate for evaluating interaction effects between adjacent components in waste packages. Three testing programs were initiated this year to quantify anticipated conditions in salt and basaltic repository systems. In the first effort, natural rock salt was gamma irradiated in the dry (as-received) condition and also in the presence of saturated brine. The aim was to determine pH and total base concentration changes in brine arising from the interaction of the irradiated salt and migrating brine inclusions. The second effort was designed to evaluate the aqueous corrosion conditions around a carbon steel container in the presence of a bentonite/crushed basalt packing and gamma irradiation. The last testing program was designed to estimate the speed at which water could penetrate this packing and reach the container. Data from these tests are described. 40 references, 18 figures, 9 tables.

18176 **(NUREG/CR—3674) Designing vegetation covers for long-term stabilization of uranium mill tailings.** Beedlow, P.A. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-76RL01830. 98p. (PNL—4986). NTIS, PC A05/MF A01 - GPO $4.75; GPO Dep. Order Number DE84009247.

The use of vegetation and vegetation-rock combinations for long-term stabilization of uranium mill tailings is discussed. Interactions between surface covers and the tailings containment system are identified and used as the basis for designing protective covers. The role of vegetation in erosional processes is reviewed and the effectiveness of vegetation for controlling erosion in the western US is discussed. Principles of revegetation are presented. Environmental influences on vegetation are reviewed. The effects of surface covers on water dynamics within the containment system are presented. A systematic approach is given for designing protective covers using vegetation. 153 references, 17 figures, 9 tables.

18177 **(ORNL/TM—8913) Development of processes for the solubilization of uranium from waste leach residue.** Seeley, F.G.; Kelmers, A.D.; Laggis, E.G. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009118.

Two processes, capable of solubilizing enriched uranium from refractory leach residue solids generated at the Y-12 processing facility, have been developed and tested on a laboratory scale. Both processes take advantage of a sinter step, followed by leaching with nitric acid. One process, designated the Calsinter method, uses a source of CaO as a sintering media to react with refractory metal silicates and provide subsequent solubilization of uranium from the sinter matrix by an acid leach. The sintering step in this case requires a temperature of approximately 1200°C. The second process employs fluoride in the sinter media to free the uranium from any refractory silicate, thus rendering it soluble in subsequent acid leaching. A sintering temperature of 700 to 900°C is used in this process. Both methods are capable of solubilizing 90 to 99% of the uranium remaining in the leach residue which, after current solids leaching treatment at the Y-12 Plant, still contains 1 to 3% enriched uranium. Uranium concentrations in final leached residues (after the sinter/leach techniques) have been reduced to as low as 500 to 1000 μg U/g. Physical and chemical characterizations of the Y-12 leach residue are discussed. Inconel trays or high-magnesia refractory material have been shown to be potential materials of containment for the Calsinter step. Sinter reaction and leaching parameters are presented and discussed. 9 tables.

18178 **(ORNL/TM—9025) Dissolution of HFIR control plates.** Posey, J.C. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009482.

A process was developed for the dissolution of High Flux Isotope Reactor (HFIR) control plates. These plates consist of aluminum metal, intensely radioactive europium oxide, and a small amount of tantalum metal. The radioactive solution will be diluted, mixed with grout, and disposed of by shale fracture. The plates are dissolved in nitric acid using a mercury catalyst. Conditions were

determined that would produce a reaction rate compatible with existing equipment. 3 references, 1 figure, 3 tables.

18179 **(PNL—4963) Commercial waste treatment program annual progress report for FY 1983.** McElroy, J.L.; Burkholder, H.C. (comps.). (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84009023.

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This annual report describes progress during FY 1983 relating to technologies under development by the Commercial Waste Treatment Program, including: development of glass waste form and vitrification equipment for high-level wastes (HLW); waste form development and process selection for transuranic (TRU) wastes; pilot-scale operation of a radioactive liquid-fed ceramic melter (LFCM) system for verifying the reliability of the reference HLW treatment proces technology; evaluation of treatment requirements for spent fuel as a waste form; second-generation waste form development for HLW; and vitrification process control and product quality assurance technologies.

18180 **(PNL-SA—11680) Fugitive dust control at uranium mill tailings piles.** Elmore, M.R.; Hartley, J.N. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 10p. (CONF-840245—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008302.

From 6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste; Fort Collins, CO, USA (1 Feb 1984).

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Possible wind erosion of the tailings is one concern associated with the disposal of uranium mill tailings. If eroded, the tailings could subsequently deposit on areas outside the impoundment. Pacific Northwest Laboratory (PNL), under contract to the US Nuclear Regulatory Commission (NRC), is investigating various techniques for fugitive dust control at uranium mill tailings piles. This paper presents the results of both laboratory and field studies. The laboratory studies have included wind tunnel testing of 43 commercially available chemical stabilizers. Fifteen of the more promising stabilizers were applied to test plots on a tailings pile at the American Nuclear Corporation - Gas Hills Project mill site, Gas Hills, Wyoming, and were monitored quarterly for ~ 1 year. Of the stabilizers tested, three synthetic polymer (latex) emulsions were more effective than the other stabilizers: Wallpol 40-133 from Reichold Chemicals, SP-400 from Johnson-March Corporation, and CPB-12 produced by Wen Don Corporation. A summary of ongoing assessments of these chemical stabilizers and an evaluation of the effectiveness and durability of commercial wind screens in reducing fugitive dust on tailings piles are also presented in this paper. 2 references, 4 figures, 2 tables.

18181 **(PNL-SA—11771) Expected environment for waste packages in a salt repository.** Pederson, L.R.; Clark, D.E.; Hodges, F.N.; McVay, G.L.; Rai, D. (Pacific Northwest Lab., Richland, WA (USA)). 1983. Contract AC06-76RL01830. 11p. (CONF-831174—84). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008340.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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This paper discusses results of recent efforts to define the very near-field (within approximately 2 m) environmental conditions to which waste packages will be exposed in a salt repository. These conditions must be considered in the experimental design for waste package materials testing, which includes corrosion of barrier materials and leaching of waste forms. Site-specific brine compositions have been determined, and standard brine compositions have been selected for testing purposes. Actual brine compositions will vary depending on origin, temperature, irradiation history, and contact with irradiated rock salt. Results of irradiating rock salt, synthetic brines, rock salt/brine mixtures, and reactions of irradiated rock salt with brine solutions are reported. 38 references, 3 figures, 2 tables.

18182 **(PNL-SA—11805) Suitability of vegetation for erosion control on uranium mill tailings: a regional analysis.** Beedlow, P.A.; McShane, M.C. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 23p. (CONF-840245—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008339.

From 6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste; Fort Collins, CO, USA (1 Feb 1984).

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Inactive uranium mill tailings (UMTRAP sites) in the West were grouped into three major climatic regions to evaluate the adequacy of vegetation for long-term stabilization: the Colorado Plateau, the West Slope of the Rocky Mountains, and the Northern Great Plains. Four general vegetation types were found at western sites: grasslands, shrub-steppe, and saltshrub and woodland. Soil-loss rates, calculated using the Universal Soil Loss Equation, were variable within regions and vegetation types, but trends were apparent. Calculations indicated that vegetation or vegetation plus a layer of surface rock provided adequate stabilization against long-term average soil loss for slopes less than 10% at the UMTRAP sites evaluated. However, detailed analyses of erosion due to severe storm events, gully formation and channel cutting is necessary for designing protective covers at each site. 11 references, 3 figures, 3 tables.

18183 **(PNL-SA—11818) Uranium mill tailings management: cover systems, containment migration and long-term stability.** Hartley, J.N.; Gee, G.W.; Foley, M.G. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 15p. (CONF-840218—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008323.

From 113. annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers; Los Angeles, CA, USA (26 Feb 1984).

This paper summarizes the research on uranium mill tailings management, including cover systems, liners, and long-term stabilization.

18184 **(RFP—3589) Laboratory-scale evaluations of alternative plutonium precipitation methods.** Martella, L.L.; Saba, M.T.; Campbell, G.K. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 8 Feb 1984. Contract AC04-76DP03533. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007334.

Plutonium(III), (IV), and (VI) carbonate; plutonium(III) fluoride; plutonium(III) and (IV) oxalate; and plutonium(IV) and (VI) hydroxide precipitation methods were evaluated for conversion of plutonium nitrate anion-exchange eluate to a solid, and compared with the current plutonium peroxide precipitation method used at Rocky Flats. Plutonium(III) and (IV) oxalate, plutonium(III) fluoride, and plutonium(IV) hydroxide precipitations were the most effective of the alternative conversion methods tested because of the larger particle-size formation, faster filtration rates, and the low plutonium loss to the filtrate. These were found to be as efficient as, and in some cases more efficient than, the peroxide method. 18 references, 14 figures, 3 tables.

18185 **(SAND—77-0962C) Thermal conductivity of S.E. New Mexico rocksalt and anhydrite.** Acton, R.U. (Sandia National Labs., Albuquerque, NM (USA)). 1977. Contract AC04-76DP00789. 14p. (CONF-770847—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009049.

From 15. international thermal conductivity conference; Ottawa, Ontario, Canada (24 Aug 1977).

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The thermal conductivity of several rocksalt materials has been determined. Some of the materials were core samples from well AEC 8, Carlsbad, New Mexico. These samples ranged from nearly pure halite (NaCl) to nearly pure anhydrite ($CaSO_4$). Core sample crystallite size ranged from about 3 centimeters to essentially packed salt sand (≃ 0.5mm). The samples exhibited thermal conductivities from ≃ 1.5 to 7.5 W/mK which depended upon purity and grain size. A one meter cube of rocksalt from the Mississippi Chemical Company's S.E. New Mexico potash mine was obtained for other experiments. The thermal conductivity of one sample

from each of the orthogonal directions of the cube was measured. This material had a high conductivity of ≅ 8.5 W/mK and was very isotrophic. A core of rocksalt from the Morton Salt Company, Paynesville, Ohio had a thermal conductivity of 6 W/mK, which is in the upper band of the results on cores from well AEC 8. Finally, a concrete made with salt sand and rocksalt aggregate was determined to have a conductivity of ≅ 2 W/mK. A longitudinal heat flow apparatus was used to determine the thermal conductivity. An analysis of the experiment gave an accuracy within +- 15% on geological samples and within +- 10% on 304 stainless steel. 8 references, 5 figures, 2 tables.

18186 **(SAND—83-0144) Uranium-isotope disequilibrium in brine reservoirs of the Castile Formation, northern Delaware Basin, southeastern New Mexico. I. Principles and methods.** Lambert, S.J.; Carter, J.A. (Sandia National Labs., Albuquerque, NM (USA); Oak Ridge National Lab., TN (USA)). Feb 1984. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007443.

We evaluated uranium isotope activity ratios with respect to models for the origin of the brines in two brine reservoirs in the Castile Formation (ERDA No. 6 and WIPP No. 12). In Castile anhydrite, a completely closed water system that was continuously leaching Th-recoil-produced ^{234}U from freshly exposed surfaces of fractured host rock would give rise to uranium 234/238 isotope activity ratio (α) values significantly higher than observed values. Therefore, the brine occurrences are not the result of continuous deformation. Similarly, a model assuming movement of intergranular Permian seawater into fractures was found inconsistent with observed uranium isotope systematics. The observed α-values (95% confidence limits) of ERDA No. 6 (1.34 to 1.58) and WIPP No. 12 (1.74 to 2.54), used in conjunction with an inferred intial α_0 higher than observed values, allows calculation of reasonable finite minimum ages, involving no preferential leaching of ^{234}U in the host rock. If the brine occurrences are inferred to have been connected at one time with a more extensive nearby hydrologic system, the Capitan limestone ($\alpha_0 = 5.1$), calculated minimum ages of isolation from that system are 700,000 to 880,000 yr for ERDA No. 6 and 360,000 to 610,000 yr for WIPP No. 12. These ranges in ages are the 95% confidence limits based on experimental determinations of α-values. The ages thus derived may reflect an episode of structural deformation in the Pleistocene that allowed water to enter the resulting fractures. 16 references, 6 figures.

18187 **(SAND—83-1646) Uniaxial compression test series on Topopah Spring tuff from USW GU-3, Yucca Mountain, Southern Nevada.** Price, R.H.; Spence, S.J.; Jones, A.K. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009113.

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Thirty-five uniaxial compression experiments were performed on cylindrical samples of the Topopah Spring Member of the Paintbrush Tuff obtained from drillhole USW GU-3 at Yucca Mountain, southern Nevada. Twenty samples were nominally 25.4 mm in diameter, 50.8 mm in length and 100 percent water saturated. Fourteen samples were 57.2 mm in diameter, 114.3 mm in length, and partially water saturated. All samples were deformed in compression at atmospheric confining pressure, room temperature, and a nominal strain rate of 10^{-5} s^{-1}. 11 references, 5 figures, 10 tables.

18188 **(SAND—83-2043C) Review and evaluation of the draft EPA standard (40 CFR 191).** Ortiz, N.R.; Wahi, K.K.; Chu, M.S.Y.; Siegel, M.D. (Sandia National Labs., Albuquerque, NM (USA); Science Applications, Inc., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 20p. (CONF-840307—14). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009093.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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The Environmental Protection Agency's proposed rule for the management and disposal of high-level waste (Draft Standard, 40 CFR 191) was reviewed and analyzed using the risk assessment methodology developed at Sandia National Laboratories. The methodology was exercised on hypothetical repository systems in basalt, bedded salt, and tuff. Among the issues addressed were achievability, release limits, uncertainty, and compliance. The proposed release limits were also analyzed in terms of their relationship to the health effects. The uncertainty in the input parameters of the deterministic models was taken into account in calculating releases to the accessible environment. Extensions to an existing compliance-assessment methodology are suggested that would allow one to incorporate the uncertainty associated with the frequency of occurrence of scenarios. The results indicate that, in general, the standards are achievable and the release limits are sufficiently conservative. 23 references, 6 figures, 3 tables.

18189 **(UCRL—89820-Rev.1) Thermal modeling of nuclear waste package designs for disposal in tuff.** Hockman, J.N.; O'Neal, W.C. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 19p. (CONF-840307—1-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007405.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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Lawrence Livermore National Laboratory is involved in the design and testing of high-level nuclear waste packages. Many of the aspects of waste package design and testing (e.g., corrosion and leaching) depend in part on the temperature history of the emplaced packages. This paper discusses thermal modeling and analysis of various emplaced waste package conceptual designs including the models used, the assumptions and approximations made, and the results obtained. 6 references, 6 figures, 4 tables.

18190 **(UCRL—89830) Nuclear waste package design for the Vadose zone in tuff.** O'Neal, W.C.; Ballou, L.B.; Gregg, D.W.; Russell, E.W. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 16p. (CONF-840307—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007791.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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This report presents an overview of the selection and analysis of conceptual waste package designs that will be used by the Nevada Nuclear Waste Storage Investigations (NNWSI) project for disposal of high-level nuclear waste (HLW) at the proposed Yucca Mountain, Nevada Site. The design requirements that the waste packages are required to meet are listed. Concept drawings for the reference designs and one alternative package design are shown. Four metal alloys; 304L SS, 321 SS, 316L SS and Incoloy 825 have been selected for candidate canister/overpack materials, and 1020 carbon steel has been selected as the reference metal for the borehole liners. A summary of the results of technical and economic analysis supporting the selection of the conceptual waste package designs is included. Post-closure containment and release rates are not discussed in this paper. 17 references, 2 figures, 2 tables.

18191 **NO /SUB x/ -HNO_3 removal from a low-flow process cell exhaust ventilation system.** Zumwalt, L.R.; Haire, M.J. (North Carolina State University, Raleigh, NC 27650). *Transactions of the American Nuclear Society;* **45**: 142-143(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18192 **The Defense Waste Processing Facility: an overview of project planning and execution.** Cowan, S.P.; Fulmer, D.C. (U.S. Department of Energy, Washington, DC 20545). *Transactions of the American Nuclear Society;* **45**: 46-47(Oct 1983). (CONF-831047—).

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18193 **Classification of low-level waste under 10CFR61.** Miller, A.D. (Impell Corporation, 220 Montgomery Street, San Francisco, CA 94104). *Transactions of the American Nuclear Society;* **45**: 168-169(Oct 1983). (CONF-831047—).

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18194 **Liquid radwaste: an in-depth analysis of source, storage, treatment, transportation, and disposal.** Soto, R. (Chem-Nuclear Systems Inc., 240 Stoneridge Drive, Suite 100, Columbia, SC 29210). *Transactions of the American Nuclear Society;* **45**: 153(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18195 **Sensitivity analysis of commercial nuclear waste management costs.** Guon, J.; De Wames, R.E.; Grantham, L.F.; McKisson, R.L. (Rockwell International, 8900 De Soto Avenue, Cahoga Park, CA 91304). *Transactions of the American Nuclear Society;* **45**: 120-121(Oct 1983). (CONF-831047—).

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18199 **Decomposition of a radioactive ion-exchange resin by a pyrolysis technique.** Matsuda, M.; Aoyama, Y.; Chino, K.; Kawamura, F.; Kikuchi, M. (Hitachi Ltd. Energy Research Laboratory, 1168 Moriyama-cho, Hitachi-shi Ibaraki 316). *Transactions of the American Nuclear Society;* **45**: 156-157(Oct 1983). (CONF-831047—).

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18242 **Evaluation of tuff as a medium for isolation of high-level wastes.** Vieth, D.L. (U.S. Department of Energy, Nevada Operations Office, P.O. Box 14110, Las Vegas, NV 89114). *Transactions of the American Nuclear Society;* **45**: 90(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18243 **Summary status of evaluation of basalt as a medium for isolation of high-level waste.** Deju, R.A. (Rockwell Hanford Operations, P.O. Box 800, Richland, WA 99352). *Transactions of the American Nuclear Society;* **45**: 88-90(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18244 **Disposal of decontaminated salts at the Savannah River plant by solidification and burial.** Dukes, M.D.; Langton, C.A.; Wolf, H.C. (Savannah River Laboratory, E.I. DuPont de Nemours & Co., Aiken, SC 29808). *Transactions of the American Nuclear Society;* **45**: 47-49(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18245 **Environmental implications of decontamination and decommissioning nuclear facilities.** Ausmus, B.S.; Tardiff, M.F. (Bechtel National Inc., P.O. Box 350, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **45**: 42-43(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18246 **Implementation of part 10CFR61.** Lohaus, P.; Johnson, T. (U.S. Nuclear Regulatory Commission, Washington, DC 20555). *Transactions of the American Nuclear Society;* **45**: 37(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18247 **Radiation damage effects in nuclear waste glasses.** Arnold, G.W. (Sandia National Labs., Albuquerque, NM (USA)). *Radiation Effects;* **74**: No. 1-4, 151-159(Aug 1983). (CONF-820864—).

From 4. europhysical topical conference on lattice defects in ionic crystals; Dublin, Ireland (30 Aug 1982).

Ion implantation is a convenient means of simulating α-decay damage in nuclear waste glasses. Rutherford backscattering spectrometry and elastic recoil detection show that significant near-sur-

face compositional changes can occur in leached Pb-ion implanted borosilicate glasses. In addition, the rates and mechanisms for hydration, ion exchange, and network dissolution depend upon the glass composition. A critical ion energy deposition value has been noted at which major changes occur in near-surface elemental profiles of some leached implanted glasses. An interpretation of this latter effect based on ion-track overlap and consequent plastic flow, is advanced.

18248 **Leaching of polyphase nuclear waste ceramics: microstructural and phase characterization.** Jantzen, C.M.; Clarke, D.R.; Morgan, P.E.D,; Harker, A.B. (Rockwell International Science Center, Thousand Oaks, CA). *Journal of the American Ceramic Society;* **65**: No. 6, 292-300(Jun 1982). Contract AC09-79ET41900.

The leaching of complex polyphase nuclear waste ceramics is described in the context of the geochemically established dissolution behavior of the constituent phases. Static leach tests conducted on ceramic monoliths in deionized water, in simulated silicate, and in brine groundwaters, conforming to Materials Characterization Center standards and an accelerated, microscopic leach test, were used to identify the processes. Dissolution and formation of surface passivation layers are discussed in terms of hydrolysis and the adsorption of the metal hydroxocomplexes onto the monolith surface. The factors observed to affect dissolution are pertinent to the leaching of other polyphase nuclear waste ceramics. 11 figures, 1 table.

18249 **Zeolite stability constraints on radioactive waste isolation in zeolite-bearing volcanic rocks.** Smyth, J.R. (Los Alamos National Lab., NM). *Journal of Geology;* **90**: 195-201(1982). Contract W-7405-ENG-36.

Silicic tuffs of the southern Great Basin and basalts of the Columbia River Plateau are under investigation as potential host rocks for high- and intermediate-level radioactive wastes. Nonwelded and partially welded tuffs may contain major amounts (> 50%) of the zeolite minerals: clinoptilolite, mordenite, and analcime. Densely welded tuffs and some basalt flows may contain clinoptilolite as fracture filling which limits permeability of these rocks. The cation exchange properties of these zeolite minerals allow them to pose a natural barrier to the migration of cationic species of various radionuclides in aqueous solutions. However, these minerals are unstable at elevated temperatures and at low water vapor pressures, and they may break down either by reversible dehydration or by irreversible mineralogical reactions. All of the breakdown reactions occurring with increased temperature involve a net volume reduction and evolution of fluids. Thus, they may provide both a pathway (shrinkage fractures) and a driving force (fluid pressure) for release of radionuclides to the biosphere. These reactions may be avoided by keeping zeolite-bearing horizons saturated with water and below about 85°C. This may restrict allowable gross thermal loadings in radioactive waste repositories in zeolite-bearing volcanic rocks. 3 figures.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 18182, 18183, 18188, 18218, 18239, 18245, 18248, 18266, 19080, 19094, 19115, 19117, 19118, 19119, 19120

18250 **(ANL/EIS—19) Uptake by plants of radionuclides from FUSRAP waste materials.** Knight, M.J. (Argonne National Lab., IL (USA)). Apr 1983. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE83018274.

Radionuclides from FUSRAP wastes potentially may be taken up by plants during remedial action activities and permanent near-surface burial of contaminated materials. In order to better understand the propensity of radionuclides to accumulate in plant tissue, soil and plant factors influencing the uptake and accumulation of radionuclides by plants are reviewed. In addition, data describing the uptake of the principal radionuclides present in FUSRAP wastes (uranium-238, thorium-230, radium-226, lead-210, and polonium-210) are summarized. All five radionuclides can accumulate in plant root tissue to some extent, and there is potential for the translocation and accumulation of these radionuclides in plant shoot tissue. Of these five radionuclides, radium-226 appears to have the greatest potential for translocation and accumulation in plant shoot tissue. 28 references, 1 figure, 3 tables.

18251 **(CONF-840245—7) Rapid seepage of contaminants through the highwall of a uranium mill tailings pit.** Pin, F.G.; Witten, A.J.; Sharp, R.D.; Long, E.C. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007517.

From 6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste; Fort Collins, CO, USA (1 Feb 1984).

A computer code (MIGRAT) is used to quantify the migration of moisture and multiple retarded contaminants in the unsaturated zone and assess the impact of open mine disposal of uranium mill tailings. The model is applied to a generic uranium mill tailings. The model is applied to a generic uranium mill tailings pit constructed with a clay-lined bottom and steep unlined sidewalls. The migration of a two contaminant system is modeled assuming that neither contaminant decays and only one contaminant is retarded. This study shows the anticipated result that the major pathway from the pit to the underlying water table is through the sidewall and that the time scales for this pathway are much shorter than those associated with the clay liner. More importantly, this study reveals that due to the strong nonlinear character of the hydraulic properties of unsaturated soils, concentrations of the retarded contaminant may only slightly lag the nonretarded contaminant through this pathway and contamination of the uppermost aquifer by the retarded contaminant may occur shortly after contamination by the nonretarded contaminant. 2 references, 5 figures.

18252 **(CONF-840245—9) Effect of drains on the seepage of contaminants from subgrade tailings disposal areas.** Witten, A.J.; Pin, F.G.; Sharp, R.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007521.

From 6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste; Fort Collins, CO, USA (1 Feb 1984).

A numerical simulation study is performed to investigate the influence of ponded water and a bottom drain on the pathways for contaminant migration from a subgrade uranium mill tailings disposal pit. A numerical model is applied to a generic disposal pit constructed with a bottom clay liner and steep unlined sidewalls. The migration of a two-contaminant system is modeled assuming that neither contaminant decays and only one contaminant is retarded. Two dominant pathways are identified; one associated with lateral sidewall leakage and the other associated with transport through the bottom clay liner. It is found that the drain serves to reduce migration through the sidewall which, in turn, prevents the retarded contaminant from reaching the aquifer. The ponded water provides increased head which causes an accelerated vertical movement of moisture through the clay liner. 2 references, 8 figures.

18253 **(DOE/LLW—24T) Evaluation of relative hazards of phosphate products and wastes.** (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1984. Contract AC07-76ID01570. 42p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007532.

Phosphate deposits throughout the world contain uranium and thorium series radionuclides, and stable metals, in concentrations greater than average natural background concentrations. The ^{238}U series, including ^{226}Ra and decay products, is the primary radiological concern. These nuclides are redistributed among the products, byproducts, and wastes from mining and processing of phosphate ore. Radium-226 is important not only as a gamma emitter that contributes to external radiation exposure, but also as a source of ^{222}Rn and decay products. Radon decay products can accumulate in air inside structures built on reclaimed phosphate mining lands. In addition to potential radiation hazards, trace elements such as cadmium, lead, zinc, chromium, and vanadium are associated with phosphate ore and are found in some products and wastes. The natural uranium in phosphate ore is also chemically toxic. This report examines some of the exposure pathways for radiological and nonradiological hazards from the phosphate indus-

try. A proposed waste classification methodology is applied to examine the hazardous potential of phosphate products, byproducts, and wastes. 33 references.

18254 (NUREG/CR—3607) Radionuclide distributions and migration mechanisms at shallow land burial sites. 1982 annual report of research investigations on the distribution, migration and containment of radionuclides at Maxey Flats, Kentucky. Kirby, L.J. (ed.). (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 133p. (PNL—4823). NTIS, PC A07/MF A01 - GPO $5.50; GPO Dep. Order Number DE84007397.

Subsurface waters at Maxey Flats are anoxic, have a high alkalinity and contain high concentrations of ferrous, sulfide and ammonium ions and organic carbon. The trench leachates are extremely variable in composition. Prominent radionuclides include ^{3}H, ^{60}Co, ^{90}Sr, ^{137}Cs, ^{238} ^{239} ^{240}Pu and ^{241}Am. A wide spectrum of dissolved organic compounds is present in the leachates, including EDTA, polar organics and decomposition products from the waste forms. Cobalt-60 and plutonium are present as EDTA complexes and ^{90}Sr and ^{137}Cs are associated with carboxylic acid type compounds. The chemistry of these waters changes drastically as they become oxic and plutonium becomes less mobile under these new conditions. Water enters the trenches by infiltration through the trench caps, through subsidence areas, and through interfaces between new landfill and the original soil. Lateral flow is very complex and slow, and apparently occurs mainly by fracture flow. The plastic infiltration barrier installed in 1981 to 1982 has been effective in reducing soil moisture if cracks and leaks are eliminated. To date, no direct evidence of radionuclide transport to offsite locations by subsurface flow has been confirmed. The offsite distribution of radionuclides, except for tritium, is comparable to the ambient fallout from nuclear weapons testing. Tritium concentrations in water offsite are orders of magnitude below MPC levels. 24 figures, 31 tables.

18255 (ORNL/TM—8990) Field demonstration of in situ treatment of buried low-level radioactive solid waste with caustic soda and soda ash to immobilize ^{90}Sr. Spalding, B.P. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009115.

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A low-level radioactive solid waste disposal trench was injected on four occasions with solutions of caustic soda, soda ash, caustic soda, and lime/soda ash, respectively. Because investigations had indicated that ^{90}Sr could be coprecipitated with soil calcium carbonate by treatment with soda ash, this demonstration was undertaken as a test of its technical feasibility. After concentrations of ^{90}Sr and water hardness decreased within the intratrench monitoring wells; one well at the foot of the trench decreased from over 100 to a persistent level of less than 10 kBq of ^{90}Sr per liter. Recharge of ^{90}Sr from the trench to a sump immediately below was reduced by about 90%. Water hardness and ^{90}Sr concentrations were strongly correlated through time within each monitoring well, indicating that ^{90}Sr behaved as a tracer for soil calcium and magnesium. The disappearance of ^{90}Sr from the trench water, therefore, was an in situ water softening. Soil samples retrieved from the trench indicated that as much as 98% of the total ^{90}Sr was present as a coprecipitate with calcium carbonate. The hydrologic characterization of this trench indicated an average void space of 41% and an average trench-wall hydraulic conductivity of 3.4×10^{-7} m/s. Sampling of the trench's discharge contamination plume indicated that it had resulted from a combination of subsurface seepage and bathtub overflow during infrequent periods of intense precipitation. A generic assessment of soda ash treatment indicated that treatment would be most effective for soils of high cation exchange capacity with either low (< 20%) or high (> 80%) basic cation saturation of that cation exchange capacity.

18256 (SAND—83-2042C) Comparison study of different source models for high-level waste. Chu, M.S.; Axness, C.L. (Sandia National Labs., Albuquerque, NM (USA); Lujar Software Services, Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 23p. (CONF-840307—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008029.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The release rate of radionuclides from the engineered facility of a repository can be described with a source model. This paper presents a comparison of the effects of different source models on the performance of a repository. A constant, an exponential and a time- and temperature-dependent leach rate model were analyzed for a basalt repository system. Integrated discharges at the accessible environment were calculated for each model and normalized by the release limits prescribed by EPA. Results were obtained for each of the three models with and without radionuclide solubility-limit constraints. Analyses were also performed for cases where backfilled regions in the repository were modeled as a mixing cell where leached materials are mixed uniformly. Results from these analyses indicated that (1) the difference in the repository performance was minor between the constant and the exponential leach models, (2) the leach rate averaged over time appears to adequately simulate the more detailed time-dependent leaching behavior and (3) the use of a mixing cell model has a significant impact on the far-field consequences. 13 references, 7 figures, 5 tables.

18257 (SAND—83-2044C) Radionuclide releases from a hypothetical nuclear waste repository: potential violations of the proposed EPA standard by radionuclides with multiple aqueous species. Siegel, M.D.; Erickson, K.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 28p. (CONF-840307—7). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008032.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The purpose of this work is to develop a methodology to identify physicochemical conditions where chemical speciation of radioelements must be considered in nuclear waste repository risk assessments. Previous studies of the compliance of hypothetical high-level waste repositories with the proposed EPA standard (40 CFR part 191) have used radionuclide retardation factors that describe the average effect of all chemical interactions of the radionuclide within the fluid and with the rock matrix. The above approach may underestimate radionuclide discharges and disguise potential violations of the EPA standard. In the method described in this paper, an approximate transport model is obtained that bounds the rate of chemical speciation reactions such that maximum radionuclide discharges are easily calculated. The analysis is applied to the discharge of 237 Np from a reference repository. A sensitivity analysis is performed that determines critical combinations of hydrologic and chemical parameters that result in discharges violating the EPA standard. 6 references, 4 figures, 2 tables.

18258 (UCRL—89869) Spent fuel cladding containment credit tests. Wilson, C.N.; Oversby, V.M. (Westinghouse Hanford Co., Richland, WA (USA); Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 14p. (CONF-840307—8). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007779.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Preliminary tests are being conducted to evaluate the effectiveness of defected cladding as a barrier to radionuclide release from spent fuel rods stored in a geological repository. The tests are being conducted at the Hanford Engineering Development Laboratory Waste Package Task of the Nevada Nuclear Waste Storage Investigations (NNWSI) tuff repository project. In these tests, spent PWR fuel rod specimens with various artificially induced cladding defects are leach tested in a test matrix which also includes both bare fuel specimens (unclad) and undefected spent fuel rod specimens. Artificial cladding defects are made by laser drilling and sawing to give defect areas in the 10^{4} to 10^{6} μm^{2} range. Periodic samples are taken of the leach solution and fused quartz rods contained in the test vessels. Results for the first 180 days of testing are presented. 5 references, 3 figures, 2 tables.

0540 Health And Safety

REFER ALSO TO CITATION(S) 18107, 18183, 18188, 18225, 18226, 18228, 18245, 18252, 18253, 19052

18259 **(BMI—1983-004) Experiments to validate the assumptions on Pu release in an aircraft crash.** Seehars, H.D.; Hochrainer, D. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Sep 1983. 156p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

An aeroplane crash on a Plutonium storing and processing fuel element factory induced by the impact on the ground and the combustion of the kerosene mechanical destruction and oxidation and as a consequence atomization of pellets. The mass distribution of such powders and powders which are stored in the factory, were determined. The release of these powders as well as from Pu-nitrate within the respirable fine dust range was studied during a kerosene fire inside a glove-box. At a sampling time of 4 minutes the release was found to be between 0.005% and 0.12% of the mass of the Pu-compounds, which were exposed to the fire. Experiments with CeO_2 as a substitute for radioactive material for release and dispersion up to 1 km from the fire were carried out.

18260 **(BMI—1983-005) Experiments to validate the assumptions on Pu release in an aircraft crash.** Seehars, H.D.; Hochrainer, D. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Sep 1983. 110p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

This report describes simulation experiments with the substitute powder CeO_2 to study the release and dispersion of PuO_2-powder induced by kerosene fires after an aeroplane crash on a plutonium processing fuel element plant. The release rates of CeO_2-powder were found to be a nonlinear function of the kerosene combustion rate. The release rates during a "micro-scale" fire inside the glovebox (pool area some 20 cm^2) were characterized by values of less than 10 $\mu G/S$, those during a conflagration (pool area some 200 M^2) by values of somewhat more than 25 MG/S. Because of the lack of other weather conditions the dispersion experiments were exclusively realized during weak to moderate winds. Small scale fire induced maximum inhalation hazards from PuO_2-powder used in production essentially exceeded those of large scale conflagrations. Obviously the activity intake by inhalation exceeded to some extent the admissible threshold of the annual activity intake.

18261 **(DP-MS—83-142) Red oil explosions at the Savannah River Plant.** Durant, W.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 9p. (CONF-840392—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008185.

From DOE/ANL training course on prevention of significant nuclear events; Augusta, GA, USA (12 Mar 1984).

Two red-oil explosions occurred at the Savannah River Plant. The first of these was in an evaporator at the semiworks prior to plant operation. The second occurred 22 years later in an A-Line facility calciner (called a denitrator).

18262 **(K/HS—26) Operational safety requirement implementation for UF_6 autoclaves.** Golliher, W.R. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 27 Feb 1984. Contract W-7405-ENG-26. 21p. (CONF-840392—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007576.

From DOE/ANL training course on prevention of significant nuclear events; Augusta, GA, USA (12 Mar 1984).

The process of sampling and feeding is an important operation in handling UF_6 in a gaseous diffusion plant. The Operational Safety Requirement (OSR) for implementation of this process is described in this paper.

18263 **(RISO-M—2275) Dose reduction by ploughing down gamma-active isotopes.** Roed, J. (Risoe National Lab., Roskilde (Denmark)). Dec 1982. 30p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700108.

This report discusses the effectiveness and feasibility of various treatments, especially ploughing, for reducing the doses on farmlands that have been contaminated with radioactive isotopes. Experiments have been conducted where contamination has been spread on three 100 m^2 farmland areas that have subsequently been ploughed with a 14-inch moldboard plough. The reduction factor of the dose rate has been found to be around 5, by measuring the rate 1 m above the surface before and after ploughing. The reduction factor for a large area, on the other hand, is calculated to be 3 times as great, or approximately 15. The purpose of the ploughing procedure was to place the contaminated surface in the bottom of the furrow. However, an investigation of the distribution of the contamination in the vertical direction revealed that this ideal distribution was not at all reached. To produce the desired distribution, and reduce doses through ploughing, it is recommended that either a tracer plough or one that is able to place the uppermost layer in the furrow without altering the intermediate layer positions be used. It is suggested that this latter type of plough be developed.

18264 **(SAND—84-0035C) Preliminary analysis of the risk of transporting nuclear waste to potential candidate commercial repository sites.** Madsen, M.M. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 27p. (CONF-840307—6). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008033.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

In accordance with the provisions of the Nuclear Waste Policy Act of 1982, environmental assessments for potential candidate sites are required to provide a basis for selection of the first site for disposal of commercial radioactive waste in deep geologic repositories. A preliminary analysis of the impacts of transportation for each of the five potential sites will be described. Transportation was assumed to be entirely by truck or entirely by rail in order to obtain bounding impacts. This paper will present both radiological and nonradiological risks for the once-through fuel cycle. 11 references, 4 figures, 7 tables.

18265 **(UCRL—89660) NCIS - a Nuclear Criticality Information System (overview).** Koponen, B.L.; Hampel, V.E. (Lawrence Livermore National Lab., CA (USA)). Jul 1983. Contract W-7405-ENG-48. 16p. (CONF-8309105—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008382.

From International seminar on criticality experiments and data; Dijon, France (20 Sep 1983).

A Nuclear Criticality Information System (NCIS) is being established at the Lawrence Livermore National Laboratory (LLNL) in order to serve personnel responsible for safe storage, transport, and handling of fissile materials and those concerned with the evaluation and analysis of nuclear, critical experiments. Public concern for nuclear safety provides the incentive for improved access to nuclear safety information.

18266 **(UTNL-R—0110) Summaries of environmental safety in nuclear fuel cycles; fiscal 1979 and 1980.** (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). 1981. 163p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84780140.

Individual papers were processed for inclusion in the Energy Data Base.

0550 Regulations

REFER ALSO TO CITATION(S) 18132, 18159

18267 (JAERI-M—9999, pp 221-238) **Present status of nuclear data requested for nuclear fuel cycle.** Nishimura, Kazuaki (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8111184—; NEANDC(J)—81/U; INDC(JAP)—68/L).

From Seminar on nuclear data; Tokai, Ibaraki, Japan (26 Nov 1981).

The nuclear data utilized in different processes for uranium-plutonium fuel cycle have been investigated in the working group on Nuclear Data for Nuclear Fuel Cycle of the Japanese Nuclear Data Committee. The requested data were critically reviewed through the discussion between the users and specialists of nuclear data relevant to the subjects, and these data were reclassified into a familiar form to nuclear data community in response to the request of the users.

18268 **(K/OA—5580) NDA measurements of product, feed, and tails UF_6 in model 12A (12-in.) cylinders.** Fields, L.W. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jan 1984. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007683.

Application of a nondestructive-assay (NDA) method to determine the enrichment of UF_6 contained in Model 12A (12-in.) nickel cylinders is demonstrated. A high-purity germanium detector is used for this purpose. Included in this report is a description of the measurement and data-analysis equipment involved in the study, a description of the measurement method, and a discussion of the measurement results. Results show that a relative accuracy of +- 2.0% can be obtained from measurements of the enrichment of UF_6 from 0.2 to 4.6% ^{235}U contained in Model 12A (12-in.) UF_6 cylinders in field environments. Results from this study are of interest to both domestic and international safeguards verifications of UF_6 contained in 12-in. diameter cylinders.

18269 **(K/OA—5615) UF_6 sample bottle assay meter.** Ricci, E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jan 1984. Contract W-7405-ENG-26. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007589.

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A UF_6 Sample Bottle Assay Meter has been developed by UCC-ND which can determine the ^{235}U concentration in UF_6 feed and product, contained in Model 1S and 2S sample cylinders, with accuracy and precision better than 1 percent. For UF_6 tails the accuracy and precision are better than 2 percent. The assay meter is based on the measurement of the 186-keV gamma rays of ^{235}U, and consists essentially of a fixed-geometry system, a portable HP Ge detector of high relative efficiency, and portable electronics. The fixed-geometry system is a combination of shield/collimator for the detector and holders for the Model 1S and 2S cylinders. The assay meter was designed for the IAEA to perform attribute accountability verification measurements at enrichment plants. Use of the assay meter by the IAEA would be advantageous for the IAEA, since it would reduce the number of mass spectrometry (variables) determinations needed, and it would enable the IAEA inspector to obtain good precision results immediately at the enrichment facility during the inspection visit.

18270 **(LA—9942) Demonstration of near-real-time accounting: the AGNS 1980-81 miniruns.** Dayem, H.A.; Baker, A.L.; Cobb, D.D.; Hakkila, E.A.; Ostenak, C.A. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 252p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84008004.

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Near-real-time nuclear materials accounting was demonstrated in a series of experiments at the Allied-General Nuclear Services (AGNS) Barnwell Nuclear Fuels Plant. For each experiment, the second and third plutonium cycles were operated continuously for 1 wk processing uranium solutions. Process data were collected in near-real time by the AGNS computerized nuclear materials control and accounting system and were analyzed for uranium removals using decision analysis techniques. Although the measurement system primarily consisted of process-monitoring measurements that were not optimized for near-real-time accounting, the results of uranium-removal tests showed that removals and unexpected losses from the process area can be detected. Los Alamos used process-grade measurements to close hourly materials balances. Loss-detection sensitivities for 1 day of between 4 and 18 kg of uranium, at 50% detection probability and 2.5% false-alarm probability, were calculated for selected accounting areas. Using pulsed-column inventory estimators, we calculated a total four-column inventory that was within 10% of column dump measurements. Loss-detection sensitivity could be improved by incorporating online waste stream measurements, improving laboratory measurements for process streams, and refining the pulsed-column inventory estimates.

18271 **(NUREG—0430-Vol.4-No.1) Licensed fuel facility status report. Inventory difference data, January-June 1983. Volume 4, No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Mar 1984. 12p. NTIS, PC A02/MF A01 - GPO. Order Number DE84900867.

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NRC is committed to the periodic publication of licensed fuel facilities inventory difference data, following agency review of the information and completion of any related investigations. Information in this report includes inventory difference data for active fuel fabrication facilities possessing more than one effective kilogram of high enriched uranium, low enriched uranium, or uranium-233.

18272 **(Y/DG—16209) Bar code usage in nuclear materials accountability.** Mee, W.T. (Oak Ridge Y-12 Plant, TN (USA)). 1983. Contract W-7405-ENG-26. 7p. (CONF-830709—30). NTIS, PC A02; 3; GPO Dep. Order Number DE84008268.

From 24. annual meeting of the Institute of Nuclear Materials Management; Vail, CO, USA (10 Jul 1983).

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The Oak Ridge Y-12 Plant began investigating the use of automated data collection devices in 1979. At this time, bar code and optical-character-recognition (OCR) systems were reviewed with the purpose of directly entering data into DYMCAS (Dynamic Special Nuclear Materials Control and Accountability System). Both of these systems appeared applicable, however, other automated devices already employed for production control made implementing the bar code and OCR seem improbable. However, the DYMCAS was placed on line for nuclear material accountability, a decision was made to consider the bar code for physical inventory listings. For the past several months a development program has been underway to use a bar code device to collect and input data to the DYMCAS on the uranium recovery operations. Programs have been completed and tested, and are being employed to ensure that data will be compatible and useful. Bar code implementation and expansion of its use for all nuclear material inventory activity in Y-12 is presented.

18273 **(Y/DG—16210) Computerized accountability program is operating - DYMCAS.** Combs, S.W.; Mee, W.T. (Oak Ridge Y-12 Plant, TN (USA)). 1983. Contract W-7405-ENG-26. 7p. (CONF-830709—29). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008266.

From 24. annual meeting of the Institute of Nuclear Materials Management; Vail, CO, USA (10 Jul 1983).

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The nuclear materials control and accountability program in the Oak Ridge Y-12 Plant has been placed on a computerized system identified as DYMCAS (Dynamic Special Nuclear Materials Control and Accountability System). The primary gola of the DYMCAS is to assist in detecting the diversion of special nuclear material (SNM). Secondly, the system is expected to assure quality inventory reconciliations both under normal and emergency situations. The system has been installed and was placed on active status in April 1982. Since that time numerous problems have surfaced and been resolved; i.e., delays of input, hardware breakdown, and

misunderstandings of needs. An explanation of these problems, including examples and alterations that have made the system workable, are presented.

18274 **Understanding national and international safeguards: An evolutionary process.** Higinbotham, W.A. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society, Supplement;* **45**: 1(Dec 1983). (CONF-831106—).

From Topical meeting on safeguards technology - the process safeguards interface; Hilton Head Island, SC, USA (28 Nov 1983).

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

18275 **(INDC(USA)—92/G) Stable isotope research pool inventory.** (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 58p. (NEANDC(US)—217/A; DOE/NDC—32). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008015.

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This report contains a listing of electromagnetically separated stable isotopes which are available at the Oak Ridge National Laboratory for distribution for nondestructive research use on a loan basis. This inventory includes all samples of stable isotopes in the Research Materials Collection and does not designate whether a sample is out on loan or is in reprocessing. For some of the high abundance naturally occurring isotopes, larger amounts can be made available; for example, Ca-40 and Fe-56.

18276 **(JAERI-M—82-108) Computer-aided simulation model for hydrogen isotope separating column by cryogenic distillation.** Kinoshita, Masahiro. (Japan Atomic Energy Research Inst., Tokyo). Aug 1982. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700653.

This paper complements and extends the previously reported works by the same author on the mathematical simulation model for hydrogen isotope separating column by cryogenic distillation. The convergence features of the proposed mathematical simulation procedure are investigated in detail and several significant estimation methods for initial values of a set of temperatures and phase flows are developed for ensurance of high efficiency of the iterative calculation as well as achievement of convergence. Discussions are made on the effects of decay heat of tritium and nonideality of the hydrogen isotope solutions on steady state column performance.

18277 **(KAERI/MR—43/82) Production and development of radioisotopes.** Kim, Y.K.; Lee, J.D.; Bang, H.S.; Han, H.S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 13p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700110.

Radioisotopes production by TRIGA MARK III reactor, were supplied to users. Recently, their applications in the field of medicine, pure and applied science, agicultural studies, etc., are on the rapid increase. In 1982, 306.5 Ci (211,437 thousand Won) of non-sealed radioisotopes mainly radiopharmaceuticals and 566.6 Ci (21,291 thousand Won) of radiation sources for non-destructive test were supplied to users. The total production amount of radioisotopes has reached 232,728 thousand Won (873.1 Ci) and showed 24% increase over last year. Especially pertechnetate and technetium compounds have increased 40% over last year. Radioisotopes (sup(99m)Tc and its compounds) have been delivered to hospitals in the Seoul area, not later than 9 a.m. by the early morning processing. The quality control method for sup(32)P used in studies of genetic engineering, was improved and established.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 18950

18278 **(GKSS—83/E/23) Measurement of the 14 MeV neutron flux distribution within the cylindrical irradiation space of the KORONA neutron tube.** Anders, B.; Boessow, E. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1983. 19p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750861.

The 14-MeV neutron flux distribution inside the cylindrical irradiation space of the KORONA neutron tube was measured by means of several niobium wires positioned perpendicular and parallel to the axis of the cylinder. Special efforts were made for the region where the capsule and its carrier called rabbit are irradiated. The ^{93}Nb(n,2n)sup(92m)Nb reaction was used for the analysis throughout.

18279 **(JINR—9-82-866) Development of neutron laser generator with 10^{10} neutron/s yield.** Bykovskij, Yu.A.; Kozyrev, Yu.P.; Kozlovskij, K.I.; Kucher, A.M.; Bulatov, S.M.; Tsybin, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700111.

A compact neutron generator for the production of 14 MeV neutrons and 10^{10} neutron/s yield is described. A laser ion source is used for production of deuterons. Deuterons are accelerated to 130 MeV in microsecond pulses with a frequency of 25 Hz. The feasibility of increasing the neutron yield to 10^{11} neutron/s is demonstrated at the same compactness of the device. The sensitivity of determining Au and U was estimated to equal 10^{-6} g/g, when the laser neutron generator is used for neutron activation analysis.

18280 **(KAERI/MR—35/82) Operation of the irradiation facilities.** Yoo, Y.S.; Chung, H.W.; Jin, J.H.; Park, S.C.; Chang, H. S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 57p. (In Korean). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700115.

In 1982, 48 companies utilized the 100kCi Co-60 irradiation facility for sterization of their medical products and food products such as gauze sponges, absorbent cotton, ginseng powder and etc. A total of 12,411 cartons of 44 different items of medical products and foods were irradiated for radiosterilization and total operation time was 5,582.3 hours. Source activity of radiosterilization facility was strengthened by supplementing 52,766 Ci Co-60 source. Radiation dosimetry for stationary and dynamic condition in the irradiation cell was done and dose distribution in irradited box was measured after supplement of Co-60 source. Ceric sulfate dosimeter system was used for routine dosimetry in order to guarentee the radiation dose and radiation dosimetry was performed 568 times. In order to develop suitable plastic material for radiosterilization, experiments on the protective effect of hydrocarbon oil on the oxidative degradation of polypropylene were performed. The pre-sterilization counting of contaminated microorganism was carried out on the 6 medical product and the sterility of the irradiated medical product was confirmed accoring to the K.P. IV and U.S.P. XX.

18281 **(ZFI-Mitt—69) Radioisotopes application and radiation processing in industry. Selected papers of the second working meeting at Leipzig, 28 September-1 October, 1982.** (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. 482p. (CONF-8209206—). NTIS (US Sales Only), PC A21/MF A01. Order Number DE84780139.

From 2. working meeting on radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Individual papers were processed for inclusion in the Energy Data Base.

18282 (ZfI-Mitt—70, pp 122-127) **Determination of the PbO content of lead glass samples by gamma absorption.** Vegvari, I.; Juhasz, I. (Veszpremi Vegyipari Egyetem (Hungary). Szilikatkemiai Kutato Csoport). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A simple method to measure PbO concentrations in lead glass is presented. The method based on gamma absorption has the accuracy of 0.3 to 0.4 % in the range of 20 to 30 % of PbO.

18283 (ZfI-Mitt—70, pp 335-355) **General considerations concerning the use of the X-ray analyzer RALE in industry.** Mueller, D.; Morgenstern, P.; Riedel, W. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Varvaritsa, V.P.; Kolesnikov, B.E.; Anders, N.A.; Filatov, V.J. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Radiatsionnoj Tekhniki, Moscow (USSR)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The X-ray analyzer RALE for light elements was tested under laboratory conditions. Particularities of X-ray analysis concerning the use of the proportional scintillation detector for X-radiation and an alpha particle source for excitation are described. The performance of the analyzer was estimated. The results demonstrate that this analyzer will be of great advantage for the solution of many analytical problems in industry. This is illustrated by means of any applications concerning the determination of concentration power engineering of elements and the thickness of thin layers in the field of power engineering including nuclear power engineering as well as in the field of metallurgy. The essential advantage of this analytical method consists in the extention of X-ray analysis to the region of elements with low atomic numbers.

18284 (ZfI-Mitt—70, pp 187-196) **Sealed sources - Problems of design, measurement and quality control.** Vormum, G. (Akademie der Wissenschaften der DDR, Berlin-Buch. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A survey is given of the most important steps of the manufacture of sealed sources. These comprise the choice of appropriate radionuclides, fixation of the radioactivity, sealing methods and material as well as measurement of the activity and quality control.

18285 (ZfI-Mitt—70, pp 232-247) **Experience and future trends in industrial application of nuclear methods in Hungary.** Hirling, J. (Magyar Tudomanyos Akademia, Budapest. Izotopintezete). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

General features and future trends of research and development activities in the field of industrial applications of nuclear methods in Hungary are reported.

18286 (ZfI-Mitt—70, pp 60-79) **Optimization of concentration determinations in heterogeneous materials based on beta backscattering measurements.** Burek, R.; Zurawicz, J.K. (Technical University of Lublin (Poland)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

It has been demonstrated that an error due to variations of the chemical composition can be reduced by energy selection of incident and backscattered beta beams. The physical and practical aspects of this fact has been discussed.

18287 (ZfI-Mitt—70, pp 80-87) **Analysis of carbon content in crude brown coal by inelastic scattering of neutrons and the method of time correlated associated particles.** Heinrich, B. (Technische Univ., Dresden (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

First experimental results of carbon content determination in graphite and brown coal samples are presented. The γ-radiation after inelastic scattering of 14-MeV neutrons is measured. To suppress the intense background the time correlated associated particle method (TCAMP) is used. The applicability of this method for determining the calorific value of brown coal is discussed.

18288 (ZfI-Mitt—70, pp 88-93) **Determination of calcium and iron and measurements of ash content in the brown coal.** Urbanski, P.; Jankowska, M.; Kowalska, E. (Institute of Nuclear Research, Warsaw (Poland)); Wagner, D. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A method for determining calcium, iron, and ash by XRF analysis in brown coal is presented. A simple theoretical model is proposed and results obtained are discussed.

18289 (ZfI-Mitt—70, pp 97-104) **Considerations relating to the prediction of the efficiency of radiometric methods for the continuous ash content determination of coal.** Thuemmel, H.W. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

For the on-stream determination of the ash content of coal mainly radiometric methods based on the transmission, scatter-transmission or backscattering of high energy X-rays (40 to 60 keV) are proposed. These methods are sensitive to variations of the mass attenuation coefficient and the density of the coal.

18290 (ZfI-Mitt—70, pp 105-113) **Monitor of ash content of coal with X-ray source.** Wawrzonek, L. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The coal ash monitor is used on-line to measure the ash content of raw, washed and blended coals. The instrument consists of a presentation unit and electronic unit. In the presentation unit a compact layer of coal is formed and there is also a radiation measuring system. A plutonium 238 source is used and the backscattered X-rays are detected by a proportional counter. The count rate is processed in the electronic unit and displayed as the ash percentage in the coal. A wide range of Polish coals was analysed. The monitor was tested in a power plant over the period of one year. The ash content in the coal analysed was in the range 5 to 50%. The gauge readings were compared with the pyrolysis results. An accuracy of 3.2% (95% confidence limit) was reached. These results were not corrected for the free moisture content which varied in the range 5 to 15 %.

18291 (ZfI-Mitt—70, pp 197-209) **New trends in the development of radioisotope gauges in Poland.** Gasiorowski, L. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Considerations on present and future trends in the development of radiometric gages in Poland are presented. It could be foreseen that scientific and technical efforts will tend to wider use of microprocessor systems, use of optic fibres technics, develop-

ment of new methods and instruments for analytical purposes and wider use of XRF spectrometers.

18292 (ZfI-Mitt—70, pp 9-16) **Studies of drying of paints by means of ^{14}C-labelled compounds.** Hecht, P.; Otto, R. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Gerber, K. (VEB Werkzeugmaschinenkombinat 'Fritz Heckert', Karl-Marx-Stadt (German Democratic Republic). Forschungszentrum). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A simple method is reported for analysing the actual content of an individual volatile component in the paint film during the process of drying. Among other things it could be shown that an interaction between the binder and the solvent can take place. This affects the drying process of the paint.

18293 (ZfI-Mitt—70, pp 17-22) **Investigations by the aid of radioisotope methods on the technology of the production of carbon and silicon carbide materials.** Wagner, K.; Brutschin, F. (Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Chemische Technologie); Ritter, I.; Graetsch, T.; Zimmermann, H.; Borchert, H. (VEB Elektrokohle Berlin-Lichtenberg (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Radiotracer and autoradiographical methods are very helpful to determine the distribution of several components in carbon or silicon carbide products after milling, mixing, and transport. Neutron activation analysis is used e.g. for the detection of impurities in pure graphite.

18294 (ZfI-Mitt—70, pp 23-33) **Determination of metal extraction process parameters using tracer technique.** Gloe, K.; Muehl, P. (Akademie der Wissenschaften der DDR, Dresden. Zentralinstitut fuer Festkoerperphysik und Werkstofforschung). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The experimental determination of process parameters of liquid-liquid extraction is shown. Basic information on various factors influencing the extraction system can be obtained by using radioactive tracers. Examples are presented and discussed.

18295 (ZfI-Mitt—70, pp 34-43) **Studies of liquid-liquid extraction of noble metals using radiotracers.** Migdal, W.; Lada, W.; Malec-Czechowska, K. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Studies of liquid-liquid extraction of gold, platinum, palladium and silver with petroleum or synthetic sulphides have been carried out from chloride, nitrate, and nitrate-chloride media as a function of metal, acid, and extractant concentration. The extraction yield determined using radiotracers and gamma spectrometric measurements, was high for Ag, Au, and Pd, but in the case of Pt it was low.

18296 (ZfI-Mitt—70, pp 44-52) **Radiotracer investigations of benefication copper ore in the industrial flotation process.** Petryka, L.; Przewlocki, K. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Optimization of copper ore processing requires in particular the investigation of the flotation process. ^{64}Cu induced in natural ore by activation was used as a tracer. Detailed measurements were performed in an industrial flotation plant consisting of 14 cells. As a result the mean residence time of different grain size fractions of natural copper sulphide was determined for all parts of the flotation plant together with the efficiency of the flotation process.

18297 (ZfI-Mitt—70, pp 53-59) **Determination of Cu recovery degree from slags in shaft process by means of radiotracers.** Bazaniak, Z.; Palige, J. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A radiotracer method has been used for determining the recovery degree of copper from slags after converter and flash furnace processing. Re-processing of slags was carried out in a commercial shaft furnace. The tracer used was ^{64}Cu in forms of pure metal, sulphide or oxide. The method applied has been described and the results of experiments presented.

18298 **(ZfI-Mitt—70) Radioisotope application and radiation processing in industry. Selected papers of the second working meeting at Leipzig.** (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. 356p. (CONF-8209165—Suppl.). NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780089.

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Selected papers are indexed for inclusion in the Energy Data Base.

0703 Isotopic Power Supplies

18299 **(DP-MS—83-83) Reducing hot-short cracking in iridium GTA welding using four-pole oscillation.** Scarbrough, J.D.; Burgan, C.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Monsanto Research Corp., Miamisburg, OH (USA)). 1984. Contract AC09-76SR00001. 16p. (CONF-840448—3). NTIS, PC A02/MF A01. Order Number DE84008186.

From 65. annual American Welding Society convention; Dallas, TX, USA (9 Apr 1984).

Hot-short cracking, an intrinsic problem in iridium welding, has been reduced using four-pole magnetic arc oscillation. For given batches of iridium, reject rates have been reduced from 26% to 2%. The mechanics of the four-pole oscillator, the microstructural effects and the causes for improvement are discussed.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 18338, 18860

18300 **(DOE/ER/04946—5) Studies of metal-semiconductor interfaces in catalysis and energy conversion. Final report, June 15, 1978-March 14, 1984.** Chung, Y.W. (Northwestern Univ., Evanston, IL (USA)). Mar 1984. Contract AC02-78ER04946. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008222.

This report summarizes major findings on the photodecomposition of water on Pt/$SrTiO_3$. A model is presented of the strong metal-support interaction. (DLC)

18301 **(DOE/ER/05528—66) Charge separation on semiconductor surfaces: basic aspects.** Fox, M.A. (Texas Univ., Austin (USA). Dept. of Chemistry). 1983. Contract AS05-77ER05528. 8p. (CONF-8309214—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007214.

From NATO conference on marine photochemistry; Woods Hole, MA, USA (1 Sep 1983).

Principles, band theory of semiconductor redox sensitization, and mechanism of photosensitized oxidations are discussed. 8 references, 4 figures.

18302 **(LBL—17368) Quantum capture and redox storage.** Calvin, M. (Lawrence Berkeley Lab., CA (USA)). Feb 1984. Contract AC03-76SF00098. 21p. (CONF-840389—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009213.

From US-Japan information exchange seminar on photochemical energy solar conversion; Okazaki, Japan (12 Mar 1984).

A review is presented of the efforts to achieve artificial photosynthesis by electron transfer across phase boundaries using vesicle systems, particle systems and special catalysts for oxygen and hydrogen production. Future efforts will be concerned with the development of different particle systems for electron transfer and methods or the photochemical reduction of carbon dioxide to various useful compounds.

18303 **(ORNL/TM—9009) Photosynthetic water splitting. Phase I. Final report, November 1, 1980-October 31, 1983.** Greenbaum, E. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract W-7405-ENG-26. 21p. (GRI—84/0018). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006847.

Original measurements on the kinetics and mechanism of the simultaneous photoproduction of molecular hydrogen and oxygen by intact green algae were performed. It is believed that this concept of renewable energy production is technically sound and that it works with both freshwater algae and marine algae (in which seawater serves as the primary substrate). It was also demonstrated that microalgae are inherently rugged organisms and can be expected to survive for prolonged periods of time in a practical process.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 18077, 18306, 18319

18304 **(CONF-810812—61-Draft) Fixed-bed, anaerobic treatment of wastewater for energy conservation and methane production.** Scott, C.D.; Genung, R.K. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007592.

From 16. intersociety energy conversion engineering conference (IECEC); Atlanta, GA, USA (9 Aug 1981).

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The development of an energy-conserving wastewater treatment system based on a fixed-film, anaerobic bioreactor has been pursued through 2 years of pilot-plant work by Oak Ridge National Laobratory. As a result, conceptual designs for large-scale treatment systems have been developed and analyzed. These systems meet the EPA's standards for secondary treatment, require significantly less energy to operate than conventional systems, and incorporate in their design the recovery of significant quantities of the methane produced by the anaerobic decomposition of carbonaceous wastes. They have also demonstrated both simplicity and inherent stability in their operation. Projected applications for the treatment of wastewater flow rates as high as 3800 m^3/d (1 mgd) encompass approximately 86% of publicly owned treatment works in this country. ORNL is presently executing a 190 m^3/d (50,000-gpd) demonstration project in cooperation with the city of Knoxille, Tennessee and Glitsch, Inc. to investigate and enhance possibilities for commercialization of this new technology.

18305 **(CONF-811108—26) Kinetic studies in a packed-bed bioreactor.** Jennings, H.L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007526.

From Annual meeting of the American Institute of Chemical Engineers; New Orleans, LA, USA (8 Nov 1981).

Laboratory-scale wastewater treatment systems based on fixed-film bioreactors were constructed and operated to evaluate the kinetics of carbon removal by such systems. These systems were observed to remove as much as 95% of the carbon in the wastewater entering the bioreactor; this efficiency was achieved over a wide range of temperatures (18 to 36°C) for residence times of one to two and one-half days. At residence times of less than one day, the efficiency decreased rapidly; only 25% of the entering carbon was removed at a residence time of 0.25 days. These efficiencies may depend on the quantity of microorganisms contained in the fixed-films in the column. A simple kinetic model could be used to fit data for selected process operating conditions. The model was used to fit data describing only experimental runs with residence times of less than one day. Under these conditions, there was more carbon available than microorganisms could use as food. The model was also used to fit data for residence times greater than one day. Under these conditions, the overall efficiency of the column may have been limited by the amount of carbon that was available to microorganisms in some regions of the column. The simple kintic model being evaluated could not be used to describe carbon removal by the fixed-film systems over the entire range of residence times tested in this project. The systems were found to be less sensitive to temperature than to residence time in the ranges studied. This was based on evaluating the effect of temperature on the kinetic constant used in the simple model being evaluated.

18306 **(CONF-830308—14) Product evolution during pyrolysis of biomass.** Krieger, B.B.; Gerboth, M.; Chan, R. (Washington Univ., Seattle (USA). Dept. of Chemical Engineering). 1983. Contract FG02-80CS84004. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007428.

From American Institute of Chemical Engineers national meeting; Houston, TX, USA (27 Mar 1983).

Ultimate tar composition and time-resolved gas composition during lignin, cellulose, and wood pyrolysis were determined using a Box-Behnken experimental design. Composition, particle size, and heat flux were varied. Simple alcohols, phenols, and condensed aromatics were the focus. The objective was to assess the form of the relationships between original composition and tar composition. 12 references, 9 figures, 3 tables.

18307 **(DOE/CS/84004—2) Product formation kinetics in the single, large pellet pyrolysis of biomass. Final report.** Krieger, B.B. (Washington Univ., Seattle (USA). Dept. of Chemical Engineering). 1984. Contract FG02-80CS84004. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007321.

The product distribution from the combustion-level heat flux pyrolysis of a single, thermally thick particle of wood or biomass was experimentally measured. A detailed mathematical model of the experiment was developed and used to both determine the significant changes in the experimental controllables before the experiments, and after revision, for comparison to the experiments.

18308 **(DOE/ER/04222—5) Mechanistic studies related to the metal catalyzed reduction of carbon monoxide to hydrocarbons. Final report, April 1, 1977-June 30, 1984.** Casey, C.P. (Wisconsin Univ., Madison (USA)). Feb 1984. Contract AC02-77ER04222. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007963.

Studies of compounds related to proposed intermediates in the hydrogenation of carbon monoxide over homogeneous and heterogeneous catalysts have been carried out. The synthesis, structure, and reactions of metal formyl compounds have been investigated. The synthesis and disproportionation reactions of hydroxymethyl metal compounds have been explored. Reactions involving interconversion of nu^5- and nu'-C_5H_5 organometallic compounds have been discovered. New synthetic routes to bimetallic compounds with bridging hydrocarbon ligands have been developed. The first bimetallic compound with a budging CH ligand has been prepared. The hydrocarbon reaction in which the CH bond of a bridging methylidyne complex adds across a carbon-carbon double bond has been discovered. New heterobimetallic compounds linked by a heterodifunctional ligand and heterobimetallic compounds linked by a heterodifunctional ligand and heterobimetallic compounds with directly bonded early and late transition metals have been synthesized in a search for new CO hydrogenation catalysts.

18309 **(DOE/PC/40771—T2) Design of reactors for slurry Fischer-Tropsch synthesis. Interim progress report, October 1, 1978-December 31, 1979.** Satterfield, C.N.; Longwell, J.P.; Huff, G.A. Jr. (Massachusetts Inst. of Tech., Cambridge (USA)). 1979. Contract FG22-81PC40771. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007421.

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The main experimental criterion has been to design a slurry-bed reaction unit which would yield kinetic information that could be analyzed by a straightforward, differential-rate approach and be free from experimental artifacts. A mechanically stirred autoclave reactor has been employed to provide a uniform gas, liquid and solid composition. Preliminary experimental runs of the unit have revealed several flaws in our original design and the apparatus has been substantially re-constructed. Although more operator attention is now required, the apparatus is evolving into a reliable and precise piece of equipment. Throughout the design and construction of the experimental unit, safety has been an overriding concern.

18310 **(DOE/PC/50804—5) CO + H_2 reaction over nitrogen-modified iron catalysts. Quarterly technical progress report, October 1, 1983-December 30, 1983.** Delgass, W.N. (Purdue Univ., Lafayette, IN (USA)). Feb 1984. Contract FG22-82PC50804. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009046.

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The synthesis of ϵ-Fe/sub 2.7/N is confirmed by Moessbauer spectroscopy. Carburization of ϵ-iron nitride for 2.5 hours in $3H_2$/CO at 523 K starts the formation of a bulk structure similar to that seen during γ'-iron nitride carburization. Reaction of γ'-Fe_4N in $3CO/H_2$ synthesis gas at 523 K shows a better bulk stability than reaction in $3H_2$/CO. Kinetic analysis of the product distribution at the higher CO ratio confirms greater activity and selectivity maintainance. The kinetics of denitriding in both He and H_2 was studied with a mass spectrometer. Extremely rapid nitrogen loss was observed from both γ'-Fe_4N and ϵ-Fe/sub 2.7/N catalysts in H_2 at 523 K. In both cases a initial exposure to H_2 produced a significant amount of NH_3 which we ascribe to an active surface species. Hydrogenation of the bulk continued with a slow rise to a maximum about 90 seconds after the introduction of H_2. The denitriding activity of the ϵ-Fe/sub 2.7/N catalyst was significantly higher than that of the γ'-Fe_4N catalyst. In contrast, the denitriding rate of ϵ-Fe/sub 2.7/N in He was significantly slower than that in H_2 until high temperatures (773K) were reached. An overall activation energy of 41.5 kcal/mol was obtained for this process. Comparison of the denitriding rate of virgin ϵ-Fe/sub 2.7/N in H_2 with that of the same nitride after five minutes of carburization during the hydrocarbon synthesis reaction indicates large differences in the overall rate. The carburized nitride was some 300 times less active to bulk hydrogenation than the virgin catalyst, which is indicative of significant changes in the first few layers of the nitride during the initial minutes of the synthesis reaction. 17 references, 5 figures.

18311 **(DOE/PETC/TR—84/5) Experimental reactor system for investigation of indirect liquefaction catalysts in slurry phase operation.** Zarochak, M.F.; Pennline, H.W.; Schehl, R.R. (USDOE Pittsburgh Energy Technology Center, PA). Feb 1984. 39p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007876.

A detailed description of the slurry (three-phase) reactor scheme employed at the Pittsburgh Energy Technology Center for Fischer-Tropsch synthesis is reported. Emphasis is placed on materials of construction, equipment operation, and product collection and analysis. The unit's functional limits and safety features are also provided. Operational problems and the resolving remedial action are discussed. The reactor scheme now operates such that near isothermal conditions exist over the reactor internal length. Thus, with excellent temperature control assured, reliable information for evaluation of potential catalyst candidates for slurry phase Fischer-Tropsch synthesis is possible within a wide range of operating conditions. Test results with a fused-iron catalyst suspended in a paraffinic liquid medium are given as an example.

18312 **(DOE/R7/01008—T1) Recycling, heat exchange, and comminution, as means of improving the energy yield from an on-farm anaerobic digester for beef manure.** Smith, R.J.; Fedler, C.B.; Bundy, D.S. (Ames Lab., IA (USA)). Mar 1983. Contract FG47-79R701008. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84007758.

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In the Midwest, beef confinement buildings are not normally heated; consequently, during the winter the manure that is discharged from the building is at a temperature near 0 C. The cold manure slurry must be heated to 35 C for anaerobic digestion. Traditionally, slurries enter digesters unheated so the heat is supplied from the digester, which derives its heat from burning the methane produced by the digester. Thus, operating with low slurry temperatures may rob the system of a large fraction of its potential heat output. The slurry heating demand may nearly equal the surplus heat available from the system under extreme conditions. Because the mass flow rates of the influent and effluent streams are nearly the same and because the effluent stream will be 35 C, transferring heat from the effluent to the influent was considered. The fluid streams are both heterogeneous and contain large solid particles, so conventional heat-exchange equipment is unsatisfactory. A plate-type heat exchanger with oscillating fingers was developed that combined a large heat transfer area with a relatively small volume. Anomalous discrepancies among the measured differences of the hot and and cold streams were observed. With no agitation, more heat was gained by the cold stream than was lost by the hot stream. Conversely, at the highest agitation rate of 25 cycle/min, the hot stream lost more heat than was gained by the cold stream. It was concluded that the heat exchanger was working as a one- and not a seven-pass unit. The one test performed on-site with the digester flow streams was not successful because the degree of agitation was insufficient to prevent manure solids from settling. Preliminary tests with air agitation suggest that this form of agitation may solve the problem of solids suspension.

18313 **(NP—4770164) Technical and economic assessment of biogas processes employed in animal-husbandry enterprises by means of static and dynamic models.** Schaefer, R. (Technische Univ. Muenchen, Freising (Germany, F.R.). Fakultaet fuer Landwirtschaft und Gartenbau). 28 Jul 1982. 194p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770164.

The paper on hand first deals with the nature of methane digestion and the participating microorganisms and than proceeds to a comprehensive evaluation of literature on the gas yields to be expected from different types of liquid manure. For a study of possible utilizations of biogas, operational models of the production branches of dairy, bull and pig fattening at three different sizes are analyzed for their energy consumption within the enterprise and household while accounting for regional preferences and climate situation. This is followed by an energy balance established between the energy production of the biogas plant and the energy consumption of the enterprise.

18314 **(NP—4770165) Report on experience gained with agricultural biogas plants in Austria.** Haeusler, F. (Oesterreichisches Kuratorium fuer Landtechnik, Vienna). Oct 1981. 165p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770165.

The present report covers 19 biogas plants by way of a comparative study describing practical experience gained so far and drawing conclusions. Saving on external supply of energy was not the exclusive reason for building these biogas plants; octour reduction with liquid manure was another motivation precessitating measures. The plants feature a sufficient dimension lay-out as to digestion-space size and the digesters have been heat-insulated excellently. The average gas yield of 1.4 cbNm/cattle unit/d appears to be rather modest, methane proportion, however, quite frequently attains 70% of volume. 9 biogas plants have been equipped with heat-power generators. This demands a high degree of technical expenditure and the system will be profitable only if the electricity is used within the entreprise complemented by an appropriate means and method of utilizing waste heat.

16315 (PB—84-133024) Management of industrial pollutants by anaerobic processes. Obayashi, A.W.; Gorgan, J.M. (Illinois Inst. of Tech., Chicago (USA). Pritzker Dept. of Environmental Engineering). Nov 1983. 262p. NTIS, PC A12/MF A01.

The anerobic degradation of organic matter to methane is a complex interaction of basically three groups of bacteria (fermentative, acetogenic, methanogenic). This report provides a description of the different types of anerobic treatment that have been developed. The processes described in this report are the (1) Conventional, (2) Contact, (3) Upflow filter, (4) Expanded Bed, (5) Sludge Blanket and (6) the Anaerobic Rotating Biological Contactor. A summary of the application of anerobic processes on a variety of wastewaters is also covered, along with the process parameters used to control the operation. Operational parameters covered, along with the process parameters used to control the operation. Operational parameters covered are (1) pH and alkalinity, (2) nutrient requirements, and (3) temperature effects on biological processes. Biodegradation of Organic Compounds by the Anerobic Processes are covered along with the common tests used to predict biodegration. Toxicity effects, Inhibition, Antagonism and Synergism and their methods of measurement are fully evaluated.

16316 (PB—84-133768) Conversion of sewage sludge to oil by hydroliquefaction. Kranich, W.L. (Worcester Polytechnic Inst., MA (USA)). Jan 1984. 34p. NTIS, PC A03/MF A01.

A study was undertaken to determine the feasibility of converting municipal wastewater sludges into oil under hydrogen pressure. In a laboratory autoclave, raw and digested sludges were subjected to 14 MPa total pressure for 20 to 90 minutes. Aqueous suspensions were treated at about 300 C while predried sludge suspended in an oil carrier was reacted at about 425 C. When the predried sludge solids were suspended in an oil carrier, 50 percent of the organic content of sludge was converted into pentane-soluble oil; but significant amounts of oil were not produced under the conditions studied when the sludge solids were slurried in water. A commercial plant using the oil carrier process scheme would be complex with high capital and operating costs. Consequently, further development work on hydroliquefaction of sewage sludge is not recommended.

0902 Alcohol Fuels

16317 (CONF-840111—3) Immobilization method for the recovery of cellulase used in cellulose conversion to ethanol. Woodward, J.; Hillman, S.K.; Vaughen, B.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007515.

From 8. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (30 Jan 1984).

Mixtures of cellulase and β-D-glucosidase when added to fermentation systems containing a yeast or bacterium enable the latter to utilize cellulose if they are inherently unable to do so. It is essential that the enzymes be recovered and recycled if such a system is to have commercial potential. The major components of Trichoderma reesei C30 cellulase have been adsorbed onto concanavalin A-Sepharose (CAS) to give maximum loadings of 2.7, 44.7, and 1.5 units g^{-1} dry CAS at 50°C when measured with the substrates filter paper, carboxymethylcellulose and cellobiose, respectively. Cellulase immobilized by this method desorbs from the support in the presence of insoluble cellulose and interacts with the substrate. Cellulose is thus converted to ethanol by immobilized cellulase, ad β-D-glucosidase and Z, mobilis coentrapped within calcium alginate. It is proposed that reimmobilization of cellulase will take place if all the substrate is utilized and converted to ethanol by a co-immobilized yeast or bacterium. Immobilization of cellulase and β-D-glucosidase on CAS is unaffected by 10% (w/v) ethanol. There is also little effect of 10% ethanol on the activity of cellulase and β-D-glucosidase. The enzymes could be easily recovered from an ethanol containing medium by simple filtration, and reused. 15 references, 6 figures.

16318 (CONF-840111—4) Similarities and differences in pretreating woody biomass by steam explosion, wet oxidation, autohydrolysis, and rapid steam hydrolysis/continuous extraction. Schultz, T.P.; McGinnis, G.D.; Biermann, C.J. (Mississippi State Univ., Mississippi State (USA). Mississippi Forest Products Utilization Lab.). 1984. 28p. NTIS, PC A03/MF A01. Order Number DE84900774.

From 8. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (30 Jan 1984).

Steam hydrolysis processes are excellent methods for pretreating and fractionating cellulose from the other major wood components. In this study a comparison was made between four pretreatment processes: steam explosion; wet oxidation; autohydrolysis; and a new process based on rapid steam hydrolysis/continuous extraction. The biomass feedstock used was a low-cost woody substrate consisting of mixed southern hardwoods obtained by total tree chipping. The four pretreatments all employ steam or water and heat; however, there are fundamental differences between each process. The initial reaction involves a mild acid-catalyzed hydrolysis reaction of both the glycosidic bonds of the hemicelluloses and the α-ether linkage in lignin. Even though the initial reactions for the four processes are similar, the final products are quite different due to the variety of secondary reactions which occur. All four pretreatments dramatically increased the enzymatic hydrolysis rates. However, only the wet oxidation pretreatment increased the acid hydrolysis rate. The hemicelluloses were depolymerized by autohydrolysis, wet oxidation, and steam explosion. The Rapid Steam Hydrolysis/Continuous Extraction process also depolymerized the hemicelluloses but minimized further degradation of the polysaccharides. The lignin was depolymerized by all pretreatments but apparently recondensed at the higher autohydrolysis temperatures. The solid residue remaining after a 260°C Rapid Steam Hydrolysis pretreatment had an enriched cellulose content of about 70%.

16319 (DOE/PETC/TR—84/4) Stack contamination effects during small-scale combustion testing of synthetic fuels. Douglas, L.J.; Gibbon, G.A.; White, C.M. (USDOE Pittsburgh Energy Technology Center, PA). 1984. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007768.

The Analytical Chemistry Branch at the Pittsburgh Energy Technology Center has undertaken the assessment of the possible environmental impact of substituting synfuels for petroleum-based fuels in utility and industrial boilers. The assessment is based on a study of results obtained from the analysis of trace organic compounds present in the exaust gases of a fully instrumented 20-hp firetube boiler. The stack gases from petroleum-based fuels, synfuels, and methanol combustion tests have been sampled and analyzed by combined gas chromatography/mass spectrometry. The stack gas sampled during the combustion of methanol showed the presence of saturated and aromatiic hydrocarbons as well as detectable amounts of organic sulfur compounds, such as dibenzothiophene. The presence of these compounds could not be explained on the basis of methanol showed the presence of saturated and aromatic hydrocarbons as well as detectable amounts of organic sulfur compounds, such as dibenzothiophene. The presence of these compounds could not be explained on the basis of methanol combustion but suggests contamination of the 20-hp combustor-exhaust system from earlier tests using petroleum or coal-derived fuels. The previously established exhaust stack protocol was reviewed by the Combustion Technology Branch and the Analytical Chemistry Branch. It was decided that a more exhaustive protocol was required. When this revised protocol was instituted, cross-contamination and memory effects disappeared, and sampling integrity was reestablished, thus allowing the analytical data to be properly interpreted. 5 references, 7 figures, 5 tables.

16320 (DOE/R7/01041—T1) Farm alcohol fuel project. Final report. Demmel, D. (Center for Rural Affairs, Hartington, NE (USA). Small Farm Energy Project). 15 Nov 1981. Contract FG47-79R701041. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84007736.

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The Small Energy Project is a research and demonstration effort designed to assist small farmers in the utilization of energy conservation techniques on their farms. The Farm Alcohol Project was designed to demonstrate the production of alcohol fuels on

small farms in order to reduce purchased liquid fuel requirements. The Project considered the use of on-farm raw materials for process heat and the production of fuel grade, low prood ethanol in volumes up to 10,000 gallons per year. The fuel would be used entirely on the farm. The approach considered low-cost systems the farmer could build himself from local resources. Various crops were considered for ethanol production. The interest in farm alcohol production reached a peak in 1980 and then decreased substantially as farmers learned that the process of alcohol production on the farm was much more complicated than earlier anticipated. Details of Alcohol Project experiences in ethanol production, primarily from corn, are included in this report. A one-bushel distillation plant was constructed as a learning tool to demonstrate the production of ethanol. The report discusses the various options in starch conversion, fermentation and distillation that can be utilized. The advantages and disavantages of atmospheric and the more complicated process of vacuum distillation are evaluated. Larger farm plants are considered in the report, although no experience in operating such plants was gained through the Project. Various precautions and other considerations are included for farm plant designs. A larger community portable distillery is also evaluated. Such a plant was considered for servicing farms with limited plant equipment. The farms serviced would perform only fermentation tasks, with the portable device performing distillation and starch conversion.

18321 **(DOE/R7/01119—T1) Alcohol production with solar distillation. Final report, March 31, 1982-June 30, 1982.** Wuestenberg, D. (Wuestenberg (Dan), Donahue, IA (USA)). Jun 1982. Contract FG47-80R701119. 32p. NTIS, PC A03; 3; GPO Dep. Order Number DE84007719.

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The purpose of this project was to determine it an absorber in a solar distillation unit that would provide a more efficient and effective way to produce fuel grade ethanol. Four tests of distilling ethanol were made. Numerous other tests were conducted distiling water, drying an assortment at materials, cooking food, and heating various liquids. The absorber in the solar distillation unit creates much heat on the glazing. The mixture in the solar distillation unit, does not have to reach temperatures that boil water to produce distillate.

18322 **(DOE/R7/01121—T1) Agricultural energy sources and application. Final report.** McBride, C. (State Fair Community Coll., Sedalia, MO (USA)). 23 Nov 1982. Contract FG47-80R701121. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007720.

The purpose of this project was to integrate a large bale burner into an existing alcohol fuel production plant located on the State Fair Community College campus. Subsequently, this system would demonstrate the use of agricultural waste for indirect production of fuel alcohol. This primary purpose has been accomplished with successful application of the principles of hot water heating, storage, and use. The bale burner has been used to provide hot make-up water for the cooking phase of a fuel alcohol production plant and heat for a 40' x 75' building that houses the classroom and Fuel Alcohol lab. The bale burner was designed and constructed on campus.

18323 **(EGG-M—16883) Case studies of unique problems and events encountered during design, construction, and operation of three large commercial-scale fuel ethanol plants.** Jones, K.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 23p. (CONF-840111—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007666.

From 8. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (30 Jan 1984).

This paper summarizes the unique problems and events encountered during the design, construction, start-up, and operation phases of three differently constructed alcohol fuel projects. These projects were awarded cost sharing contracts (Cooperative Agreements) as part of the Department of Energy's effort to expedite ethanol production on a commercial scale. The scope of the projects included final design, economic and financial analysis, market analysis, environmental analysis, facility construction, and plant start-up operation. The three ethanol plants are a 20-million gallon per year (MMGPY) new-construction or grass roots facility; a 60-MMGPY plant constructed using refurbished equipment at a decommissioned ammonia fertilizer facility; and a 10-MMGPY retrofitted brewery. A comparison of the case histories of these projects clearly points out the advantages and disadvantages of each type of design and construction.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 19081

18324 **(DOE/R7/01023—T1) Fluid slurry pump and control apparatus - development. Final report.** Bowman, R.G. (DXXE, Inc., Weingarten, MO (USA)). 20 Dec 1981. Contract FG47-79R701023. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007747.

The description of the design and construction of a liquid slurry pump is presented with a summary of construction and testing of the prototype pump. Bio-mass materials consisting of high fiber wood particles and burnable oil mixtures were used in the project. The results of this program are given in detail outlining the evaluation of the original pump design and control scheme, and reports of the test runs with sample materials. Analysis of the slurry pump system is given, and technical data are listed. The over-all results of the project indicate that the original design was excellent, and with only minor modifications to the original scheme for fiber cut control at the outflow valve, the system can operate quite efficiently as per design intent. Liquid slurries can be used in a liquid and semi-liquid form even with fiber laden residue in the form of chips and stringers. The bio-mass material need not be homogenized nor made stable as a composite fluid. Bio-mass materials can be pumped and thus injected into furnances and process systems in their basic wet and stringy form. 4 figures.

18325 **(NP—4900857) Fire safety for your wood-burning appliance: tips for proper installation, operation, and maintenance.** (National Bureau of Standards, Washington, DC (USA)). 1984. 4p. NTIS, PC A02/MF A01. Order Number DE84900857.

A dramatic increase in house fires caused by wood-burning appliances has accompanied the rediscovery of wood as an alternative heating fuel. The National Bureau of Standards attributed the majority of these fires to conditions related to the installation, operation or maintenance of the appliances rather than malfunctions or construction defects. This publication presents guidelines for the proper installation, use, and maintenance of wood-burning appliances in the home. (DMC)

18326 **(TVA/OP/ECR—83/69) Residential wood heater test report. Phase II (1981-1983). Volume I.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Conservation and Rates). Aug 1983. 242p. NTIS, PC A11/MF A01. Order Number DE84900362.

This report concerns the second phase of the wood heater test program which involved tests on new technology wood heaters. Even though the primary purpose of the wood heater program is to benefit TVA and its customers, the results of these tests will have a positive impact far beyond the confines of the Tennessee Valley because of the nationwide interest in new technology wood heaters. This study involved the evaluation of efficiencies, emissions, and other environmental effects for five residential wood heaters. The first wood heater tested was a typical airtight circulator which is popular with consumers in the TVA area. The remaining four heaters were either catalytic or secondary combustion models. These five wood heaters were selected to provide a direct comparison between a conventional airtight model and the new technology models which are purported to offer reduced emissions and increased efficiency. 19 references, 91 figures, 39 tables.

13 HYDRO ENERGY

1301 Resources And Availability

18327 **(PB—84-133651) Commentary on Columbia River instream flows.** Coop, H.D. (Washington State Water Research Center, Pullman (USA)). Aug 1983. 29p. (R—49). NTIS, PC A03/MF A01.

The Washington State Department of Ecology in 1980 adopted the Columbia River Instream Resource Protection Plan (CRIRPP). This plan requires that flowrates in the river be at least at minimum specified levels (or higher) at all times. Columbia River flowrates are highly regulated by storage and hydropower plants. Plant discharge fluctuates accordingly to fairly-well established power demands, particularly in low water years. CRIRPP requires that streamflow regulation would need to be modified so that outflows from plants are higher than at present. In turn, this means that power demand patterns would have to be modified, significant spill would be necessary, or some of both. There appears to be sufficient runoff, even in low runoff years, specifically, to meet CRIRPP requirements at Columbia River locations upstream from the Snake River confluence.

1302 Site Geology And Meteorology

REFER ALSO TO CITATION(S) 18330

18328 **(AD-A—136129/4) Amistad power plant. Final foundation report.** Marr, A.J. (Army Engineer District, Fort Worth, TX (USA)). Oct 1983. 52p. NTIS, PC A04/MF A01.

Amistad Dam is located at approximate river mile 567 on the Rio Grande about 12 miles upstream from Del Rio, Texas. The dam consists of a 950-foot long concrete spillway section in the main river channel flanked by non-overflow concrete sections and earth embankments on each side of the spillway section, and an earth dike extending about 2.2 miles east of the United States end of the main dam. The non-overflow concrete sections of the dam include a 225 foot long power intake section on the United States side and a 223-foot long power intake section on the Mexico side. Maximum height of the dam is 254 feet with crest elevation of the spillway section at elevation 1086.4 feet above mean sea level. This report provides a complete record of foundation conditions encountered during construction of the Amistad Power Plant. Information will be valuable when evaluating (1) necessary remedial action required to prevent or repair any failures resulting from foundation deficiencies, (2) contractor claims related to foundation conditions or alleged change of conditions, and (3) planning and design of future comparable construction projects.

1303 Plant Design And Operation

REFER ALSO TO CITATION(S) 18328

18329 **(DOE/ID/12122—1) Garvins Falls Hydroelectric redevelopment project. Final operation and maintenance report.** (Public Service Co. of New Hampshire, Manchester (USA)). Jan 1984. Contract FC07-80ID12122. 67p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007793.

Operating statistics, operation and maintenance costs, and the value of energy generated for the two-year operating period are summarized. The Garvins Facility, located on the Merrimack River in Bow, New Hampshire, is part of Public Service Company of New Hampshire's (PSNH) generating system. Installation of the two new units began on August 4, 1980 and by December 1981 both of the units were on-line. During the construction period, 4900 cubic yards of rock were excavated and a powerhouse was constructed which required 3700 cubic yards of concrete and 420 tons of reinforcing steel. Each of the new tube turbines has a rated capacity of 3250 kilowatts (kW) or a total combined capacity of 6500 kW. The energy generated by these two new units will serve approximately 4900 homes and will offset the use of about 61,000 barrels of oil per year. The total construction cost for the Garvins project was $7,946,025.

1304 Regulations And Licensing

18330 **(TVA/PUB—84/23) Implementation of federal guidelines for dam safety. Biennial progress report. Agency reports of December 1981, for the reporting period, January 1980-October 1981.** (Tennessee Valley Authority, Knoxville (USA)). 1984. 224p. NTIS, PC A10/MF A01. Order Number DE84900913.

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In order to address and resolve dam safety issues and ensure an effective and coordinated federal dam safety program, the Interagency Committee on Dam Safety (ICODS) was established. This report summarizes the progress reported by the eight federal departments/agencies that are members of the ICODS in implementing the Federal Guidelines for Dam Safety between January 1980 and October 1, 1981. The activities of the 19 federal government subagencies within those principal agencies which are responsible for or involved with planning, site selection, design, construction, certification or regulation, inspection, maintenance and operation, repair, financial or technical assistance, or ultimate disposition of dams are covered.

1305 Economics And Management

18331 **(DOE/RA/04934—T34) Legal factors affecting the financing of small scale hydroelectric projects.** Wilson, W.H.; Ringo, M.J.; Forgione, N. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). Sep 1983. Contract AC07-78RA04934. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84008267.

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An introduction to the major business organizational options open to small-scale hydroelectric (SSH) projects is given. The major federal income tax treatments of these options are compared. Significant general federal income tax factors affecting SSH projects are reintroduced and explained. Some of the special federal income tax problem areas in SSH development are isolated. Tax benefit flow through or transfer mechanisms are discussed. Tax exempt financing opportunities for private SSH projects are reviewed. (MHR)

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 19128

18332 **(FERC/EIS—0017) Kootenai River Hydroelectric Project No. 2752, Montana: final environmental impact statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Apr 1981. 507p. NTIS, PC A22/MF A01; 1; GPO Dep. Order Number DE84009438.

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Northern Lights, Inc. (Applicant), of Sandpoint, Idaho, a member of the newly created Western Montana Electric Generation and Transmission Cooperative (G and T) is proposing to construct a 144 megawatts (MW) conventional hydroelectric project on the Kootenai River at river mile 193 in Lincoln County between Troy and Libby, Montana. The action would require a diversion structure (dam) with a maximum spillway elevation of 2000 feet msl that would impound the river for 3.5 miles upstream of the dam at a flow of 50,000 and 2000 cubic feet per second (cfs), respectively. The impoundment would have no storage capacity. Other project facilities would include: (1) an intake and outlet structure; (2) an access portal and tunnel; (3) a head tunnel, underground powerstation, and tail tunnel; (4) an underground switchyard and bus; (5) recreational facilities; (6) an access road; and (7) other appurtenant facilities. Transmission lines are not part of the proposed project works. Construction would commence subsequent to issuance of a license.

18333 (PB—84-141522) Distribution, abundance and entrainment studies of larval fishes in the western and central basins of Lake Erie. Cooper, C.L.; Mizera, J.J.; Herdendorf, C.E. (Ohio State Univ., Columbus (USA). Center for Lake Erie Area Research). Jan 1984. 163p. NTIS, PC A08/MF A01.

To assess the impact of entrainment of larval fishes at steam generating electrical power plants, samples were collected in Lake Erie. In 1975, 1976 and 1977 the Western Basin was sampled and in 1978 the sampling was concentrated in the Central Basin. The 1975, 1976 sampling permitted calculation of an estimated impact of entrainment of adult yellow perch and emerald shiners using the adult approach. In 1978, 25 species were collected from the Central Basin in Ohio waters of which 82.4% were gizzard shad/alewives, emerald and spottail shiners. Field collections yielded higher estimates of entrainment than in-plant collections and significant differences were found between entrainment estimates from field samples and from in-plant samples from the Central Basin for gizzard shad, rainbow smelt, carp and freshwater drum.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 18886

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 18368

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 18301, 18302, 18304, 18306, 18307, 18312, 18313, 18314, 18317, 18318, 18320, 18321, 18322, 18323, 18326, 18716, 18719, 18720, 18721, 18722, 18862, 18864, 19058, 19069, 19131

18334 (AD-P—002103/0) Charged particle effects on space systems. Hall, W.N.; Stevens, N.J. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 25 Jan 1983. 28p. NTIS, PC A03/MF A01.

There is a growing tendency to plan space missions that will incorporate very large space power systems. These space power systems must function in a space plasma environment that can impose operational limitations. As the power output increases, the operating voltage must also increase and this voltage, exposed at solar array interconnects, interacts with the local plasma. The implications of such interactions are considered here. The available laboratory data for biased array segment tests are reviewed to demonstrate the basic interactions considered. A data set for a test of a floating high voltage array illuminated in a solar simulator test is used to generate approximate relationships for positive and negative current collection from plasma. These relationships are applied to a hypothetical 100 kW power system operating in a 400 lm, near-equatorial, orbit. It is found that discharges from the negative regions of the array are the most probable limiting factor for array operation.

18335 (BMFT-FB-T—83-204) Investigation of silicon materials for solar cells. Pt. 1 and Pt. 2. Sigmund, H.; Bernt, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1983. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750499.

We investigated the solubility and segregation behaviour of Magnesium and Calcium in Silicon. Maximum solubility of Mg is $1.5x10^{19}$ cm^{-3}, of Ca $6.0x10^{18}$ cm^{-3}, the segregation coefficient at the melting point is $2.3x10^{-3}$ for Mg and $1.6x10^{-3}$ for Ca. By electrical measurements we could find a relation between the statistical spatial distribution of minority carrier lifetimes and the efficiency of solar cells. We developed a method for contact less measurement of lifetimes.

18336 (BNL—34397) Strategies for solar energy conversion utilizing metal complexes. Sutin, N. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 15p. (CONF-840389—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008184.

From US-Japan information exchange seminar on photochemical energy solar conversion; Okazaki, Japan (12 Mar 1984).

Transition metal complexes have properties which make them particularly attractive candidates for use in solar energy conversion systems. The complexes generally absorb strongly in the visible and their excited states frequently undergo rapid electron transfer. In addition, transition metal complexes are capable of undergoing multi-equivalent changes (generally required for the formation of highly reduced or oxidized species) and can be designed to have vacant or readily accessible coordination sites for the stabilization or activation of intermediates. Radiationless decays are discussed, as well as excited state lifetimes, quenching, back reactions, and cage escape yields. The focus of the work reported is on homogeneous systems rather than heterogeneous systems. (LEW)

18337 (CONF-840111—2) Net financial and energy analyses for producing Populus hybrid under four management strategies. Strauss, C.H.; Blankenhorn, P.R.; Bowersox, T.W.; Grado, S.C. (Pennsylvania State Univ., University Park (USA). School of Forest Resources). 1984. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007544.

From 8. annual symposium on energy from biomass and wastes; Lake Buena Vista, FL, USA (30 Jan 1984).

A series of commercial production and utilization alternatives were proposed for biomass energy available from short rotation Populus plantations. This report analyzes the first rotation production results from the biomass plantations. Data was obtained from research plantations established under four management strategies (control, irrigation, fertilization and fertilization-irrigation) and on two sites representing favorable and unfavorable inherent growth conditions. The rotation length was 4 years and the trees were spaced at .6 m x .8 m intervals. All aspects of plantation establishment and maintenance were cost analyzed on a commercial scale basis. These specifications involved energy and financial data from the prototype plantations and engineering evaluations of related agricultural systems. The proposed size for a working unit was 924 hectares, with 4 such units operated as a total supply system. A linear programming model of a working unit determined the most financial and energy efficient approach among the various strategy/site options. The model used the technical parameters involved in each option and the financial and energy costs for capital, labor, land and material inputs. Biomass output was priced on the basis of an energy equivalent value derived from commercial coal prices. The model indicated the optimal strategy to be fertilization on the best site. This option provided a three fold increase of energy input to output and recovered over 90% of the first rotation financial costs. 19 references, 8 tables.

18338 (CONF-840389—1) Energy transfer in real and artificial photosynthetic systems. Hunt, J.E.; Katz, J.J.; Hindman, J.C. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007278.

From US-Japan information exchange seminar on photochemical energy solar conversion; Okazaki, Japan (12 Mar 1984).

A comparative study of the fluorescence emitted by three photosynthetic organisms (chlorella, tribonema, and anacystis) and the fluorescence of some model systems selected for study by criteria described below are reported. Light emission has been studied as a function of excitation wavelength and of temperature. Low temperature fluorescence studies on photosynthetic organisms and chloroplast preparations provide the chief experimental support for the existence of a PSII in green plants, and fluorescence at low temperatures has been used as the principal source of information on energy flow between the photosynthetic pigments. The nature and functional aspects of PSII and the course of energy transfer in the photosynthetic apparatus are highly pertinent to the oxygen evolution in green plant photosynthesis.

18339 (DOE/CE—0033/2) Photovoltaic energy systems: program summary Fiscal Year 1983. (Solar Energy Research Inst., Golden, CO (USA); Jet Propulsion Lab., Pasadena, CA (USA)). Jan 1984. Contract AC02-77CH00178;AI01-76ET20356. 372p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84009179.

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Since 1975, the federal government has conducted a program to provide focus, direction, and funding for the development of terrestrial photovoltaic (solar-electric) technology. The goal of the program is to advance scientific understanding and to establish a technology base which private enterprise can use in developing photovoltaic energy-producing devices or systems for sale in the competitive energy market. Each year a program summary, such as this, is prepared to provide an overview of government funded activities within the program. This summary highlights tasks conducted in-house by the participating national laboratories or under contract by industrial, academic, or other research institutions. It covers activities initiated, renewed, or completed during Fiscal Year 1983 (FY 1983 - October 1, 1982 through September 30, 1983). This document is divided into three sections. The first includes introductory information, a list of directing organizations, a list of acronyms and abbreviations, and an index of current contractors. The second section is made up of individual activity summary sheets, grouped by directing organization. The third section is also grouped by directing organization and lists FY 1982 - FY 1983 publications.

18340 **(DOE/CS/83100—T1) New materials for luminescent solar concentrators. Final report, June 1, 1980-September 30, 1981.** Kleinerman, M. (Clark Univ., Worcester, MA (USA)). 28 Dec 1981. Contract FG02-80CS83100. 34p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84005338.

An optical study of many fluorescent dyes was carried out for the purpose of selecting building blocks for a multicomponent dye system such that the resultant dye has a high absorption coefficient throughout most of the solar uv-visible range and such that solar energy absorbed at any wavelength within this range is cascaded via intramolecular energy transfer to a chemically bonded dye with an emission band in the red-IR region. A number of dyes with attached chemically reactive groups have been obtained for preparing chains of energy donor dyes. A group of red-IR fluorescent dyes have been prepared with relatively large Stokes shifts for minimizing fluorescence reabsorption. Work on the actual synthesis of a simple multicomponent dye has been started, and needed electro-optical instrumentation has been set-up. The seemingly anomalous phosphorescence of Cu(II) porphyrins has been re-investigated, as it is related to the intramolecular energy transfer mechanisms anticipated to occur in the dyes in this work. It was tentatively concluded that in Copper Mesoporphyrin Dimethyl Ester the oxidation state of Cu is Cu(I).

18341 **(DOE/CS/83105—2) Solar cell characterization by photocapacitance. Final report, July 1, 1980-August 31, 1983.** Rothwarf, A. (Drexel Univ., Philadelphia, PA (USA). Dept. of Electrical and Computer Engineering). Dec 1983. Contract FG02-80CS83105. 152p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84008215.

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An experimental and theoretical research program to study new solar cells by electrooptical characterization and modeling was begun in July 1980 and continued under this grant until August 1983. The principal cells studied where a-Si:H and $CuInSe_2$/CdS with some work on Cu_2S/CdS and Zn_3P_2/Mg. The purpose of the grant was not only to carry out research, but to also help establish facilities and train graduate studendt in the field of solar cell research. Capabilities to characterize solar cells by photocapacitance and current voltage techniques as a function of voltage, illumination level and wavelength, temperature (77°K to 400°K), frequency, and pulses of light and voltage, were developed.

18342 **(DOE/ER/10534—3) Photogalvanic cells driven by electron transfer quenching of excited singlet states. Final technical report.** Creed, D.; Fawcett, N.C. (University of Southern Mississippi, Hattiesburg (USA)). 1983. Contract FG02-79ER10534. 43p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009099.

Photoreduction of oxonine by iron(II) sulfate in dilute acid is produced by quenching of the excited singlet state (S_1). No induced intersystem crossing to the tripolet (T_1) can be observed by nanosecond flash photolysis. The photoreduction of oxonine (S_1) by iron(II) has been used in a totally illuminated thin layer photogalvanic cell. Power conversion efficiencies are, however, very low. The fluorescence of oxonine and thiazine dyes such as thionine is quenched by acids. Oxonine fluorescence is also quenched by hydroquinone and catechol sulfonates and related compounds. Eleven new thiazine dyes have been synthesized. A few photogalvanic experiments have been carried out using high concentrations ($> 10^{-2}$N) of the water miscible dye and iron(II) in a TI/TL cell. Ferrophos, an iron-phosphorus alloy, can be substituted for platinum or gold as a cathode in photogalvanic cells.

18343 **(DOE/ER/10534—T1) Thiazine dyes for use in photogalvanic cells.** Burton, W.C. (University of Southern Mississippi, Hattiesburg (USA)). May 1981. Contract FG02-79ER10534. 84p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84009097.

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From the information gathered in this research, one of the problems of the photogalvanic cell has been solved, that of poor water solubility of the dye, but the problem of self-association remains. As seen in the case of one dye, it could not be eliminated by merely attaching hydrophilic groups to the phenothiazinium chromophore. Another dye appears to offer some hope of resolving both problems since it is almost completely miscible with water and shows very little aggregation at high concentration. However, the problem irreversible photobleaching of the dye solution will impede its use in the cell.

18344 **(DOE/ER/10534—T2) Ground and excited state chemistry of some hydrophilic thiazine dyes for possible photogalvanic applications.** Burton, W.C. (University of Southern Mississippi, Hattiesburg (USA)). Aug 1982. Contract FG02-79ER10534. 203p. NTIS, PC A10/MF A01; GPO Dep. Order Number DE84009096.

Thesis.

The research was designed to study the ground and excited state properties of hydrophilic analogues of the thiazine dye, thionine. The analogues were prepared by substituting β-hydroxyethyl or N-methylpiperazine groups onto the thiazine chromophore. Positive charges were introduced into the analogues containing the N-methylpiperazine groups by methylation of the N-methyl nitrogen atom of the piperazine ring. After purification and characterization of the analogues, ground state properties such as water solubility and aggregation were studied. Excited state studies involved determination of triplet state lifetimes (tau), and triplet state rate constants for, self quenching, (k/sub SQ/), ferrous quenching (k/sub Q/), and bromide and iodide (k/sub Br/ and K/sub I/) quenching. Oxidation and decay of the photoproducts, semireduced dyes and leuco dyes, was also studied.

18345 **(DOE/ER/10539—T1) Electrodeposition of semiconductors and photovoltaic solar cells. Final technical report.** Hanck, K.W.; Schreiner, A.F.; Littlejohn, M.A. (North Carolina State Univ., Raleigh (USA)). 1981. Contract FG02-79ER10539. 106p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84008219.

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The primary III-V materials interests of this study were GaAs and In/sub x/Ga/sub 1-x/As. Consequently, our research was guided by this materials interest, and we followed two major tracks of: (1) developing synthesis routes for Ga, In, As, and GaAs, and (2) obtaining an optical electronic structural data base for GaAs and In/sub x/Ga/sub 1-x/As. The electrochemistry of Ga, In and As in molten LiCl-KCl at 400°C was investigated first. Attempts to co-deposit Ga and As or In and As were unsuccessful due to the volatility of $AsCl_3$. Deposits having the formula Ga/sub x/As/sub 1-x/ ($0 < x < 1$) were prepared by electrolysis of aqueous alkaline solutions of $GaCl_3$ and $AsCl_3$. We were also interested in studying GaAs and In/sub x/Ga/sub 1-x/As crystal specimens of origins as currently used for device making. For this reason we studied relative band-to-band photoluminescence brightness and shallow and deep level optical bands of GaAs(Te) and InGaAs fronm OM-CVD, GaAs(Se) from ion implantation, GaAs(Si) substrates from bulk growth, and several GaAs layers from LPE used currently to make III-V cascade solar cells.

18346 **(DOE/ET/20004—T2) Establishing intensively cultured hybrid poplar plantations for fuel and fiber.** Hansen, E.; Moore, L.; Netzer, D.; Ostry, M.; Phipps, H.; Zavitkovski, J. (Department of Agriculture, St. Paul, MN (USA)). 1983. Contract AI01-77ET20004. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009122.

Intensive culture is the application of agronomic principles and practices for the attainment of forestry objectives. The system is similar to mechanized farming and is characterized by high energy inputs, high biomass yields, and complete mechanization. Intensive culture includes: (1) establishing plantations using thorough site preparation, weed control, and mechanized planting; (2) short rotation; (3) close spacing; (4) fast growing hybrids or genetically improved trees; (5) fertilization; (6) irrigation; and (7) insect and disease management. Some of the factors such as proper site preparation and weed control are essential to successful plantation establishment. Other factors may not be critical by themselves but must be incorporated to attain maximum growth. This paper describes a step-by-step procedure for establishing commercial size intensively cultured plantations of hybrid poplar and summarizes the state-of-knowledge as developed during 10 years of field research at Rhinelander, Wisconsin. 44 references, 19 figures, 8 tables.

18347 **(DOE/JPL/955909—83/11) Low Cost Solar Array Project cell and module formation research area. Process research of non-CZ silicon material. Final report, November 26, 1980-September 30, 1983.** Campbell, R.B. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). 1983. Contract NAS-7-100-955909. 307p. (WAESD-TR—83-1007). NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84004366.

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The primary objective of the work reported was to investigate high-risk, high-payoff research areas associated with the Westinghouse process for producing photovoltaic modules using non-Czochralski sheet material. These tasks were addressed: technical feasibility study of forming front and back junctions using liquid dopant techniques, liquid diffusion mask feasibility study, application studies of antireflective material using a meniscus coater, ion implantation compatibility/feasibility study, and cost analysis. (LEW)

18348 **(DOE/JPL/956312—06) Stress studies in EFG. Quarterly progress report, October 1-December 31, 1983.** Kalejs, J.P. (Mobil Solar Energy Corp., Waltham, MA (USA)). 15 Feb 1984. Contract NAS-7-100-956312. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009044.

Stress analysis at Harvard University has examined the implication of non-zero interface stresses on model predictions. Stress distributions at distances greater than about 1 mm from the interface are shown to be independent of the interface stress at high creep intensities, and the predictions based on zero initial stress can be used with confidence. Numerical models for growth dynamics developed at MIT are compared with experimental data on t-V relationships and on interface shape obtained from impurity redistribution in aluminum-doped 10 cm wide ribbon. Comparison of primary creep responses in FZ (floating zone) and CZ (Czochralski) silicon above 1200°C using four-point bending indicates that oxygen has a significant influence on the creep rate. Both the strain rate and resulting dislocation densities generated in FZ silicon are an order of magnitude higher than for the CZ material at comparable applied stress levels. A fiber optics probe suitable for temperature measurement during sheet growth has been constructed and tested. Study of the feasibility of using laser interferometric techniques for residual stress measurements has continued at the University of Illinois. The method has been successfully applied to CZ silicon, and is being evaluated for use with EFG ribbon.

18349 **(DOE/JPL/956369—83) Microcrystalline silicon growth for heterojunction solar cells. Second quarterly report, 1 April 1983-30 June 1983.** Iles, P.A.; Leung, D.C.; Fang, P.H. (Applied Solar Energy Corp., City of Industry, CA (USA)). 1983. Contract NAS-7-100-956369. 35p. NTIS, PC A03/MF A01. Order Number DE84002416.

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In this reporting period, a single source of evaporation with B mixed with highly doped Si was used instead of the co-evaporation of separate Si and B sources. The purpose was to reduce possible carbon contamination. The results of both the heterojunction or heteroface structures, however, were similar to last quarter when evaporation was used. The best Voc of the heterojunction was about 460mV and no improvement in Voc in the heteroface structure, was observed; slight Voc degradation occurred. A study of the p m-Si/p c-Si structure showed a negative Voc in many cases. The highest °C voltage was up to -150mV. This indicated that the interface properties between the two materials are such that instead of repelling minority carriers from the substrate carrier, collection actually occurred. This structure defeated the purpose, but it might also mean that n-type m-Si could be beneficial and should be included in future study. Another study of cells made in the part of substrates not covered by m-Si resulted in performance lower than the controls. This indicated possible substrate degradation in the process, the extent of which will be studied in the future.

18350 **(DOE/JPL/956615—84-1) Laser-assisted solar cell metallization processing. Quarterly report, September 13-December 12, 1983.** Dutta, S. (Jet Propulsion Lab., Pasadena, CA (USA); Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 16 Jan 1984. Contract NAS-7-100-956615. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009178.

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The Westinghouse Electric Corporation has undertaken to investigate, develop, and characterize laser-assisted processing techniques utilized to produce the fine line, thin metal grid structures that are required to fabricate high-efficiency solar cells. Two basic techniques for metal deposition will be investigated, as follows: (1) photochemical decomposition of liquid or gas phase organometallic compounds utilizing either a focused, CW ultraviolet laser (System 1) or a mask and ultraviolet flood illumination, such as that provided by a repetitively pulsed, defocused excimer laser (System 2), for pattern definition, and (2) thermal deposition of metals from organometallic solutions or vapors utilizing a focused, CW laser beam as a local heat source to draw the metallization pattern. The purpose of this contract is to investigate the various existing laser-assisted film deposition techniques in order to develop a new, cost-effective technology for solar cell metallization. The tasks that will be performed in the conduct of these investigations are detailed. In the first three months of this contract, a comprehensive literature search has been carried out on the various state-of-the-art laser-assisted techniques for metal deposition, including laser chemical vapor deposition and laser photolysis of organometallics, as well as laser-enhanced electroplating. A compact system for the experiments involving laser-assisted photolysis of gas-phase compounds has been designed and constructed. Initial experiments on laser-enhanced electro-plating have yielded very promising results, with linewidths as fine as 25 μm and plating speeds as high as 12 μm/sec being achieved.

18351 **(DOE/JPL/956698—84/1) Process Research of Polycrystalline Silicon Material (PROPSM). Quarterly report No. 1, November 8-December 31, 1983.** Culik, J.S. (Solarex Corp., Rockville, MD (USA)). 1984. Contract NAS-7-100-956698. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009314.

Recent reported results of hydrogen-passivated polycrystalline silicon solar cells are summarized. Most of the studies have been performed on very small grain or short minority-carrier diffusion length silicon. Hydrogenated solar cells fabricated from this material appear to have effective minority-carrier diffusion lengths that are still not very long, as shown by the open-circuit voltages of passivated cells that are still significantly less than those of single-crystal solar cells. The short-circuit current of solar cells fabricated from large-grain cast polycrystalline silicon is nearly equivalent to that of single-crystal cells, which indicates long bulk minority-carrier diffusion length. However, the open-circuit voltage, which is sensitive to grain boundary recombination, is 20 to 40 mV less. The goal of this program is to minimize the variations in open-

circuit voltage and fill-factor that are caused by structural defects by passivating these defects using a hydrogenation process.

18352 **(NP—4770159) Utilization of ethanol/water lignins through oxidation and hydrogenolysis, and their chemical and spectroscopic characterisation.** Meier, D. (Hamburg Univ. (Germany, F.R.). Fachbereich Biologie). 11 Jul 1980. 179p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770159.

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Monomers were recovered by the degradation of lignins on a semi-technological scale through alkaline pressure oxidation. Of main interest were the yields of vanillin and syringic aldehyde since these are of most importance from a technological-economic viewpoint. The major reaction parameters were optimized. The EW-lignins could be degraded to carbonyl compounds more easily than the alkali-lignins. This finding is discussed on the basis of own data and data from the literature. A gas chromatographic procedure was developed to identify and determine carbonylic oxidation products without the need for silycation but with reproducible results being achieved.

18353 **(NP—4770161) Production process and the properties of CdSe MIS solar cells.** Sanchez-Machet, M.S.H. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 23 Apr 1982. 192p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770161.

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The optical and electrical properties of CdSe films, prepared under different experimental conditions, are studied with respect to their future application as solar cells. A preparation technique has been developed leading to appropriate self-doped films (proportional1kΩxcm) with a strong hexagonal fibre orientation ([001]-direction) and a large grain size. In this method the substrate temperature is increased from 200°C to 400°C during evaporation. The CdSe band gap and the minimum layer thickness necessary for the application in solar cells have been determined experimentally with the result 1.67 eV and 1.64 μm respectively. An incongruent evaporation of CdSe has been observed, resulting in layers with different optical, structural and electrical properties. The experimental results indicate an increasing abundance of Cd, related with the consumption of evaporated material, which manifests itself as a doping material (monovalent) or as a trapping center material (bivalent). Cr has been found to be most usefull for the electric contacts studied in this work.

18354 **(PB—84-142629) Limitations on the efficiency of the solar photoreduction of carbon. Annual report, June 1982-May 1983.** Ross, R.T. (Ohio State Univ. Research Foundation, Columbus (USA)). Nov 1983. 69p. NTIS, PC A04/MF A01.

The ultimate cost-effectiveness of the solar photoreduction of carbon to produce gaseous fuels will depend significantly on the thermodynamic efficiency of the conversion process. The purpose of this project is to clarify the thermodynamic and kinetic limits on the efficiency of solar photochemistry in general, and the solar photoreduction of carbon in particular. In this first stage of the project, effort is focused on general limits on photoconversion efficiency, with parallel studies on the efficiency of biological photosynthesis. This year, the project has shown that a simple type of hybrid solar energy converter can have both very high theoretical efficiency (66%) and properties which are compatible with construction of a practical device. A theory has also been formulated for the loss in efficiency due to the finite width of electronic transitions. Computer programs for factor analysis have been developed to the point where the technique is beginning to give useful new information about the properties of the light conversion apparatus of green plants: Preliminary results suggest that the fluorescence quantum yield of photosystem I is less than 20% of the quantum yield of photosystem II, and that vibrations in the excited state of photosystem I are at least 30 C warmer than ambient temperature. Luminescence measurements suggest that the chemical potential of photosystem II in higher plants varies by 10%.

18355 **(SAND—83-7027) Installation of a modular photovoltaic array field with low balance-of-system costs.** Noel, G.T.; Alexander, G.; Carmichael, D.C. (Battelle Columbus Labs., OH (USA)). Jan 1984. Contract AC04-76DP00789. 76p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84009504.

A modular building block design was developed, in the preceding phase of this project, which significantly reduces the balance-of-system (BOS) and site-specific design costs associated with the installation of ground-mounted flat-panel photovoltaic array fields. A test-bed array field, nominally rated at 30 kW and consisting of three of the building blocks, has been installed in Albuquerque, NM, in this phase of the project to evaluate both the cost-effectiveness and the technical attributes of the design. Electrically, the building block is a single source circuit consisting of 164 photovoltaic modules connected as parallel pairs and is rated nominally at 10 kW with a 400 Vdc operating voltage. The structural design uses driven metal stakes and wooden transfer beams as a foundation. The panel assembly, consisting of two modules attached to steel-angle side rails, is lag-bolted to the transfer beam and held at angle by a tubular back strut. The installation was accomplished without significant difficulty and has been demonstrated to function in accordance with the design objectives. The cost of this first-time installation was $134.15 per square meter of array aperture. The cost of a second-time installation of the three-building-block field is estimated to be $78.38/m², including an allocation of $11.97/m² for a fence which was not required in the initial installation but would be needed for more typical sites. Larger fields and a significant continuous volume of construction permit further cost reduction.

18356 **(SAND—83-7459) Development of high-efficiency concentrator cell configuration. Final report.** Borden, P.G. (Varian Associates, Palo Alto, CA (USA). Solid State Lab.). Feb 1984. Contract AC04-76DP00789. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008356.

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Development of a reflective spectrum-splitting system is described. This system uses a high-bandgap cell with a reflective back contact to reflect below-bandgap light to a second cell with a lower bandgap. The report discusses system and cell design. It then describes a process for making a think, glass-bonded high-bandgap cell with a back surface reflector, appropriate for this application.

18357 **(SAND—83-7460) Development of mechanically-stacked multijunction solar cell for concentrator applications. Final report.** Bell, R.L.; Boettcher, R.J.; Borden, P.G.; Dietze, W.T.; Grounner, M.; Kaminar, N.R.; Lewis, C.R.; Ludowise, M.J. (Varian Associates, Palo Alto, CA (USA). Solid State Lab.). Feb 1984. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008355.

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Development of a mechanically-stacked, multijunction solar cell is described. The cell uses a thin, high-bandgap cell bonded to the top of a silicon cell. Two electrical leads are brought out from each cell in the stack so that the cells may be operated electrically in parallel while they are optically in series. This report discusses modeling and packaging of the cascaded cells. It also describes a process for making a thin, high-bandgap AlGaAs solar cell.

18358 **(SAND—84-1074C) Observations of damage and transport of hydrogen in ion bombarded polycrystalline silicon.** Sharp, D.J.; Panitz, J.K.G.; Seager, C.H. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840258—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008035.

From Materials Research Society spring meeting; Albuquerque, NM, USA (27 Feb 1984).

A combination of chemical etching and sheet resistivity measurements showed that intense (1.4 mA/cm2) low energy (1400 eV) ion beam hydrogenation of polycrystalline silicon having a columnar structure can produce electrical defect passivation to depths on the order of 100 um. Transmission electron micrographs disclose surface and near-surface features resulting from the ion beam bom-

bardment which suggest that one of the hydrogen transport mechanisms may be defect induced.

18359 **(SERI/STR—211-2092) Survey of the preparation, purity, and availability of silanes.** Lorenz, J.H. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1983. Contract AC02-83CH10093. 87p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84000090.

Silane and disilane are currently available as prepared for the semiconductor market. Published or public information on preparative methods for monosilane and higher silanes are discussed. Purification techniques are reviewed. Data from current silane suppliers are tabulated. A short review of the silanes in Japan is given. Analytical procedures are not now perfected to determine group 3 or 5 elements in silane. All commercial silanes contain certain impurities. There is no simple one step purification technique for silane which a user could easily operate. Typical and actual analyses of commercial silane are given. Disilane is still in the development stage with only small quantities available at very high prices. The silane process developed in part under the DOE/JPL Flat Plate Solar Array project by Union Carbide is summarized. Higher purity silanes are now appearing on the market. These should be useful in the photovoltaic area.

18360 **(SERI/TR—9100-2-T1) Exploratory Development Program for silicon-on-ceramic (SOC). Final report.** Zook, J.D.; Chapman, P.W.; Grung, B.L. (Honeywell Corporate Technology Center, Bloomington, MN (USA)). 26 Aug 1982. Contract AC02-77CH00178. 68p. NTIS, PC A04/MF A01. Order Number DE83003011.

The basic objective of the work reported was to explore various technical approaches for manufacturing low-cost, high-efficiency photovoltaic modules using silicon-on-ceramic (SOC) technology. The two fundamental approaches investigated were: modules using epitaxial silicon grown on SOC substrates that used metallurgical-grade (MG) silicon or refined metallurgical-grade (RMG) silicon feedstock, and SOC modules using semiconductor-grade (SG) silicon feedstock. Major conclusions are reported related to module manufacturing analysis, SOC coating technology, and performance of SOC solar cells. (LEW)

18361 **Comparison of hydrogen fluoride saccharification of lignocellulosic materials with other saccharification technologies.** Hawley, M.C.; Selke, S.M.; Lamport, T.T.A. (Michigan State Univ., East Lansing). *Energy in Agriculture;* **2**: No. 3, 219-244(Nov 1983).

Laboratory investigations have been conducted for the past year in the MSU-DOE Plant Research Laboratory in collaboration with Chemical Engineering at Michigan State University on the hydrogen fluoride (HF) saccharification of cellulose and wood. The work is an extension of the work done by Fredenhagen in Germany reported in 1933. The authors produce evidence that HF saccharification of lignocellulosic materials when compared with hydrolysis saccharification techniques has the important features of: (1) high conversion of cellulose and hemicellulose to simple sugars; (2) recycle of HF in the process thereby eliminating the need for major acid neutralization requirements; (3) a valuable lignin by-product for chemical use; and (4) no elaborate pretreatment requirements. High sugar yields and chemically useful lignin are essential in the long term if biomass is to replace petroleum and later coal as sources of chemical raw materials and liquid fuels. There are several laboratory investigations recommended in order to more fully evaluate the potential of HF saccharification of lignocellulosic materials. These investigations include studies on reaction conditions versus yield, removal and recycle methods, post-hydrolysis conditions versus oligomer distribution, sugar separation methods, and basic studies on uses for xylose and lignin. Results of these studies could be utilized to develop a process design and economic evaluation of the HF technology and to identify those processing steps which require pilot scale experimentation. 74 references, 5 figures, 4 tables.

18362 **Relationship between the blue response and open-circuit voltage of high performance silicon solar cells.** Green, M.A.; Blakers, A.W. (Solar Photovoltaic Lab., Joint Microelectronics Research Center, Univ. of New South Wales, Kensington 2033). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **ED-30**: No. 10, 1360(Oct 1983).

The relationship between the response at blue wavelengths and the open-circuit voltage of high performance silicon solar cells with a virtually "transparent" emitter is analyzed. It is shown that a one-dimensional cell model cannot simultaneously model the optical collection properties and operating characteristics of such cells. The analysis highlights the importance of surface conditions and shows that previous conclusions regarding bounds on Auger coefficients imposed by correlating these parameters must be treated with caution.

18363 **Production of liquid fuels and chemicals through anaerobic digestion of biomass.** Wentworth, R.L.; Levy, P.F.; Wisp, D.L. (Dynatech R/D Company, Cambridge, MA). *Institution of Chemical Engineers Symposium Series;* **78**: T6/57-T6/66(Oct 1982). (CONF-8210188—). Contract AC02-77ET20050.

From European Federation of Chemical Engineers conference on energy; London, UK (12 Oct 1982).

Through suppression of methane generation, anaerobic fermentation of biomass yields fatty acids convertible to alkanes, olefins, alcohols, and esters through Kolbe electrolysis. Experimental data for the required processing steps show how this route to production of liquid motor fuel is economically feasible. Alternatively, the process may be operated to emphasize yield of selected chemicals.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 18339

1407 Solar Thermal Power Systems

18364 **(ALO—3994-83/2) Solar Total Energy Project, Shenandoah, Georgia site. Annual technical progress report, July 1, 1982-June 30, 1983.** (Georgia Power Co., Atlanta (USA)). 1983. Contract FC04-77ET20216. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84004770.

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A part of the National Solar Thermal Energy Program, initially funded by DOE, the Shenandoah Project, is the world's largest industrial application of the solar total energy concept. The objective of the Project is to evaluate a solar total energy system that provides electrical power, process steam, and air conditioning for a knit-wear factory (operated by Bleyle of America, Inc.). During normal operation, solar energy generates a large part of the electricity and displaces part of the fossil fuels normally used to run the factory and produce the clothing. Construction of the system was completed early in 1982, when operations were initiated. Solution of unexpected electrical and mechanical problems produced significant information for subsequent system designs. An overview of the Project and a brief System Description is presented following a chronological summary of progress. A discussion of varius anomalies, together with subsequent high quality solar and thermodynamic system performance results, is then discussed.

18365 **(ANL/EES-TM—240) Thermal energy storage in molten-salt systems for solar central receivers: the federal role in research and development.** Michaels, A.I.; Mueller, R.O. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 32p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007433.

Since 1978, the US Department of Energy (DOE) has conducted a program to develop TES for solar-thermal applications (the TESSTA program). This research and development (R & D) program has been carried out through two divisions under DOE's Assistant Secretary for Conservation and Renewable Energy. Spe-

cifically, the Division of Energy Storage Technology (EST) within the Office of Energy Systems Research has directed the TESSTA effort using funds provided by the Division of Solar Thermal Energy Systems (STES) within the Office of Renewable Technology. The TESSTA program, which has been closely tied to a broader STES effort to develop solar central receivers, has included: exploratory research to identify and study new energy-storage materials and processes and improved techniques for containing the heat-storage media, which may be corrosive; base-technology R & D, including component design and development and laboratory-scale experimentation; and feasibility tests of large TES systems in partnership with industry. The TESSTA program has emphasized development of second-generation and advanced TES systems to support solar central receivers that use either molten salt or liquid sodium as the heat-transfer and -exchange medium. This report summarizes the decisions and achievements of the EST Division's TESSTA program, beginning with a brief review of the central receiver program. Also discussed are the program structure and funding and (2) the assessment of the Federal role.

18366 **(DOE/DP/00789—T92) First year average performance of the SSPS-DCS Plant.** van Steenberghe, T.J. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). Aug 1983. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006886.

The IEA-sponsored SSPS (Small Solar Power Systems) demonstration project is composed of two solar power plants of different technologies, namely a Solar Tower Plant or Central Receiver System (CRS) and a Solar Farm Plant or Distributed Collector System (DCS). Among the aims of this project is the collection of long term operational data in order to evaluate the performance of these plants as electrical power plants. This paper reports on operational data obtained for the DCS Plant over its first year of operation, to illustrate the observed long term average performance of the plants.

18367 **(DOE/DP/00789—T93) SSPS-DCS first year of operation. Verification of design expectations preliminary operational results.** Kalt, A. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). Jul 1983. Contract AC04-76DP00789. 49p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84006887.

This report summarizes operation and evaluation results of the Distributed Collector System (DCS) Plant within the SSPS Project. The results presented cover a period from one to one and a half years from plant acceptance in September 1981 until May 1983. The figures and tables published are mostly based on evaluation results presented by the International Test and Evaluation Team, as well as investigations of the supplying industry and the author's own work. The most important results are summarized in chapter 2. The remaining chapters deal with: meteorological situation on the plant site; comparison of design expectations and actual performance; preliminary routine operation experience; and failures and degradation.

18368 **(DOE/ET/20422—3) System safety design criteria for the central receiver solar thermal power system.** (Martin Marietta Corp., Denver, CO (USA)). Apr 1977. Contract AC03-76ET20422. 66p. (STMPO—277; MCR—77-161). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84006572.

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The objective of the System Safety Design Criteria is to provide the basic safety criteria for the design of the solar thermal pilot plant. These safety criteria were developed for the Energy Research and Development Administration (ERDA) to provide all contractors developing systems/subsystems for the solar thermal pilot plant with a common safety design reference. Protection of personnel and systems by incorporation of safety into the basic design to eliminate or control hazards is the primary goal of this document. Development of these criteria was based upon the standard safety requirements of a generic solar thermal pilot plant that includes a collector field, receiver/tower system, thermal storage system and an electrical power generation system. These criteria assume each individual system will contain the necessary controls to operate independently and will supply the necessary interface commands to the Master Control System. An individual evaluation of the Master Control System has not been included in this report since its design will be determined by the selected pilot plant concept.

1408 Ocean Energy Systems

18369 **(CONF-830667—2) Sampling strategies for environmental data useful in design modification of ocean energy systems: an OTEC case study.** Dengler, A.T. (California Univ., Berkeley (USA). Marine Sciences Div.). 1983. Contract AT03-83CE89302. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84005040.

From 3. symposium on coastal and ocean management; San Diego, CA, USA (1 Jun 1983).

The Ocean Thermal Energy Conversion (OTEC) program is completing the conceptual design phase and entering the preliminary design phase of a 40 MWe pilot plant. During all design phases, there is a constructive feedback between the design of the plant and the body of data which describes the oceanographic and environmental setting of the plant. The design of the plant helps to define what data are gathered, and the data help refine the design of the plant. During conceptual design, development has proceeded on two baseline designs. Both designs are sited at the coast near Kahe Point, Oahu, Hawaii. The two designs are: (1) a shelf-seated artificial island, connected via a causeway to Oahu, using stainless steel heat exchangers, with the thermal resource enhanced by effluent from a near-by power plant, ammonia working fluid and biocide (chlorine) cleaning; and (2) a shelf-mounted tower 1 mile offshore using submerged aluminum heat exchangers, R-22 (freon) working fluid, and slurry cleaning with biocide (chlorine) backup. The designs are driven by engineering and socio-legal requirements which are in part defined using environmental and oceanographic data pertinent to the site. These requirements may be related to the data through four groupings of environmental concerns: (1) siting, design and operational criteria; (2) thermal resource evaluation and variability; (3) biological and chemical issues; and (4) regulatory requirements. The design, the requirements and the data are continually upgraded in concert.

18370 **(SERI/TP—252-2149) Artificial upwelling driven by salinity differences in the ocean.** Johnson, D.H.; Decicco, J. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1983. Contract AC02-83CH10093. 8p. (CONF-840201—10). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84000086.

From ASME energy sources technology conference and exhibition; New Orleans, LA, USA (12 Feb 1984).

A concept for an artificial upwelling driven by salinity differences in the ocean to supply nutrients to a mariculture farm is described and analyzed. A long shell-and-tube counterflow heat exchanger built of inexpensive plastic and concrete is suspended vertically in the ocean. Cold, nutrient rich, but relatively fresh water from deep in the ocean flows up the shell side of the heat exchanger, and warm but relatively saline water from the surface flows down the tube side. The two flows exchange heat across the thin plastic walls of the tubes, maintaining a constant temperature difference along the heat exchanger. The plastic tubes are protected by the concrete outer shell of the heat exchanger. The flow is maintained by the difference in density between the deep and surface water due to their difference in salinity. This phenomenon was first recognized by the oceanographer Stommel, who termed it The Perpetual Salt Fountain. The heat transfer and flow rate as a function of tube number and diameter is analyzed and the size of the heat exchanger optimized for cost is determined for a given flow of nutrients for various locations. Reasonable sizes (outer diameter on the order of 5 m) are obtained. The incremental capital cost of the salinity-driven artificial upwelling is compared to the incremental capital cost and present value of the operating cost of an artificial upwell fueled by liquid hydrocarbons.

18371 **(SERI/TR—252-1991) Mist eliminators for freshwater production from open-cycle OTEC systems.** Bharathan, D.; Penney, T. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1983. Contract AC02-83CH10093. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84000088.

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For freshwater production from open-cycle OTEC systems, the suitability of commercially available mist eliminators is examined. The mist eliminators are characterized in terms of their liquid collection efficiencies, allowable vapor velocities at the onset of reentrainment, and pressure losses. Suitable design modifications can be projected to allow steam velocities of up to 35 m/s, with a corresponding parasitic power loss of less than 5% of the gross potential of an open-cycle OTEC power system.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 18321, 18376, 18629

18372 **(DOE/CE/30744—1) Measurement of performance of solar-heated office buildings. Final report, June 1, 1982-October 31, 1983.** Norford, L.N.; Rabl, A.; Socolow, R.H. (Princeton Univ., NJ (USA). Center for Energy and Environmental Studies). Jan 1984. Contract AC02-82CE30744. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84006725.

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Prudential Insurance Company is building two new office buildings that are a showcase of innovative energy efficient design and solar energy utilization. In order for this effort to be fully successful, the actual performance of these buildings needs to be monitored. This report summarizes the progress made during the first year. A thorough theoretical analysis has been carried out, using the DOE2.1 computer simulation code. This analysis has been supplemented by shorthand calculations and by special models to provide an independent check of the coding and to evaluate certain features, e.g. the double wall, that cannot be modeled by DOE2.1. A steady state shorthand method has been developed to calculate annual energy use; it is a modification of the ASHRAE bin method and agrees with the computer simulation within about 15% for cooling and 2% for heating. Energy savings due to daylighting have been evaluated using both shorthand methods and the computer code DOE2.1b. The calculations of annual energy use that were performed at the design stage have been reproduced, and changes during later design phases, e.g. the outdoor air flow rate, have been identified. Even without a variety of further energy savings that appear feasible, these buildings promise to be among the most efficient in the current stock of office buildings. A 100-channel instrumentation and data acquisition system has been designed, and installation should be complete by February 1984. Extensive software has been prepared to confront the model predictions with field data.

18373 **(SERI/TP—254-2020) Measured performance of 50 passive solar residences in the United States.** Swisher, J.N.; Duffy, J.J. (Solar Energy Research Inst., Golden, CO (USA); Duffy (J.J.) and Associates, Winchester, MA (USA)). Jul 1983. Contract AC02-77CH00178. 6p. (CONF-830929—9). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE83011986.

From 8. national passive solar conference; Santa Fe, NM, USA (5 Sep 1983).

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This paper summarizes the thermal performance of 50 passive solar residences in a variety of US locations. These buildings were monitored as part of the Solar Energy Research Institute (SERI) Residential Class B Passive Solar Performance Monitoring Program. The paper describes the monitoring and performance evaluation methods and presents the overall heating season performance of the buildings in graphical form. Some general conclusions from these results and the validity of extrapolating such conclusions to passive solar buildings in general is discussed.

18374 **(SOLAR/1114—83/14) Solar energy system performance evaluation update: Cushing Home, Murray, Utah, October 1982-May 1983.** Kendall, P.W. (Vitro Corp., Silver Spring, MD (USA)). 1983. Contract AC01-79CS30027. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84005857.

The Cushing Home site utilizes a 457-square-foot monolithic single-panel drainback collector array consisting of an Ethylene Poly-Diene Monomer (EPDM) rubber collector absorber mat integrally mounted on the south-facing roof of the home, single-glazed with fiberglass. The array is connected to a site-built storage system. Energy distribution is accomplished via stored liquid pumped through EPDM mats embedded in the basement and first floor concrete slabs. Auxiliary energy is provided through an in-line 12-kW electric heater. Energy is distributed to the 2450-square-foot living space via radiant energy transfer from the floor slabs. A 450-gallon vinyl-lined storage tank is located in the basement. The home itself is well insulated with six inches of wall insulation, and double-glazed windows with interior storm windows on the first floor. There was a solar contribution of 41% to a system load of 42.5 million Btu over the eight-month monitoring period. Collector Coefficient of Performance (COP) was 31, an excellent return on purchased power for the collector pump. Overall system COP was 7.4, based on total solar applied to the loads, quite a bit less than the previous year. Consistent DHW preheating capability provided 32% of the hot water load of 4.93 million Btu.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 18205, 18340

18375 **(UT/CES-SS—1) Effect of operating temperature on the HWB model for solar-collector design.** Hanhao Huang; Howell, J.R. (Academia Sinica, Beijing (China). Inst. of Energy Conversion; Texas Univ., Austin (USA). Center for Energy Studies). Feb 1983. 25p. NTIS, PC A02/MF A01. Order Number DE84900248.

The Hottel-Whillier-Bliss or HWB Model for the thermal efficiency of a flat-plate solar collector plots as a straight line in an eta/sub c/ ~ (T/sub f,in/ - T/sub a/)/q/sub s/ coordinate system under the following assumptions: (1) The effect of the thermal capacity in the collector is negligible; (2) F/sub R/, U/sub L/ are constant in the range of operating temperature. These assumptions simplify the model and make it convenient to use. However, because of the intermittance of insolation and the variation of ambient temperature and wind speed, the thermal capacity of the collector may affect the transient efficiency of the collector. In addition, the values of F/sub R/ and U/sub L/ are actually not constant and cause deviation of the efficiency curve from a straight line. Our concern here is: how much deviation will cause, or, in other words, what is the confidence level for a specific operating range. The effect of operating temperature of the values of F/sub R/ and U/sub L/ is discussed.

1420 Heat Storage

REFER ALSO TO CITATION(S) 18365

18376 **(ORNL/Sub—82-17460/1) Development of heat storage building materials for passive solar applications.** Fletcher, J.W.; Price, J.M.; Tucker, S.P. (Lockheed Missiles and Space Co., Inc., Huntsville, AL (USA). Research and Engineering Center). Feb 1984. Contract W-7405-ENG-26. 63p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009121.

The objective of this study was to develop a heat storage building material to be used for passive solar applications and load leveling within residential/commercial building spaces. Three phase change materials (PCMs) were evaluated for use in double-walled, hollow-channeled plastic panels as replacements for standard wallboard and ceiling panels. Performance tests conducted during this study indicate that the PCM-filled plastic panels can be completely charged/discharged on a daily basis by convective and radiative means. Typical PCM related problems with containment, nuclea-

tion, corrosiveness, incongruent melting, supercooling, heat transfer, and cycle lifetime have been addressed, and no significant barriers to future development are anticipated. Computer simulated comparisons of a PCM and conventionally fitted passive solar building indicate a significant improvement in heating requirements and thermal comfort using the PCM ceiling and wall panels. Overheating of the structure was also reduced dramatically during fall and spring months, substantially reducing cooling (ventilation) requirements.

15 GEOTHERMAL ENERGY

18377 **(DOE/CE/77011—1) Geothermal Progress Monitor. System status and operational experience.** Gerstein, R.E.; Medville, D.M. (Mitre Corp., McLean, VA (USA). METREK Div.). Nov 1983. Contract AC01-82CE77011. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84010264.

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The Geothermal Progress Monitor (GPM) system was designed and implemented by MITRE for DOE's Division of Geothermal Energy (now the Division of Geothermal and Hydropower Technologies). This report summarizes MITRE's operational experience with the system during fiscal year 1983 and provides a qualitative assessment of its data sources.

1501 Resource Status And Assessment

18378 **Advancements in the utilization of geothermal energy in western USA.** White, D.H.; Mathews, H.B.; Wolf, D.; Young, T.L. (University of Arizona, Tucson, Arizona). *Institution of Chemical Engineers Symposium Series;* **78**: T6/27-T6/41(Oct 1982). (CONF-8210188—).

From European Federation of Chemical Engineers conference on energy; London, UK (12 Oct 1982).

The ten Western States have abundant geothermal energy. Installed electrical power capacity exceeds 900 MW, with a proven resource capacity of 3000 MW. Power developments are in progress in California, Utah and Nevada. Process applications of interest to chemical engineers in mining and pumping are detailed, along with potential research opportunitites.

1502 Geology And Hydrology Of Geothermal Systems

18379 **(EUR—8541) Investigation of the geothermal potential of the UK. Geothermal aspects of the Larne No. 2 borehole.** Downing, R.A.; Burgess, W.G.; Smith, I.F.; Allen, D.J.; Price, M. (Commission of the European Communities, Luxembourg). 1984. 92p. NTIS, PC E05/MF E05.

The Larne No 2 borehole is a geothermal exploration borehole drilled in 1981 in Larne, Northern Ireland. It was drilled almost entirely in Permo-Triassic rocks and was completed in the Permian at a depth of 2880 metres. Although thick sandstones were encountered in both the Triassic and the Permian, their permeabilities are generally low. The upper 300 m of the Triassic sandstones are water-bearing and should yield 30 l/s of brine at a temperature of about 40C. The yield from the Lower Permian sandstones was negligible.

18380 **(NMEX—4900830) Geology and geothermal waters of Lightning Dock region, Animas Valley and Pyramid Mountains, Hidalgo County, New Mexico.** Elston, W.E.; Deal, E.G.; Logsdon, M.J. (New Mexico Bureau of Mines and Mineral Resources, Socorro (USA)). 1983. 64p. New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801.

This circular covers the geology of the Pyramid Peak, Swallow Fork Peak, Table Top Mountain, and South Pyramid Peak 7-1/2-min quadrangles, which include the Lightning Dock KGRA. Hot wells (70 to 115.5°C) seem to be structurally controlled by intersections of the ring-fracture zone of an Oligocene ash-flow tuff cauldron (Muir cauldron), a Miocene-to-Holocene north-trending basin-and-range fault (Animas Valley fault), and a northeast-trending lineament that appears to control anomalously heated underground waters and Pliocene-Pleistocene basalt cones in the San Bernardino, San Simon, and Animas Valleys. The Muir cauldron, approximately 20 km in diameter, collapsed in two stages, each associated with the eruption of a rhyolite ash-flow-tuff sheet and of ring-fracture domes. Most of the hydrothermal alteration of the Lightning Dock KGRA is related to the first stage of eruption and collapse, not to the modern geothermal system. Contrary to previous reports, no silicic volcanic rocks younger than basin-and-range faulting are known; unconformities beneath rhyolite ring-fracture domes are caused by Oligocene caldera collapse, not by basin-and-range faulting. The Animas Valley is the site of widespread post-20 My travertine deposits and near-surface veins of calcite, fluorite, and/or psilomelane, controlled by north- or northwest-trending basin-and-range faults. The fluoride-bearing waters of the Lightning Dock KGRA may be a late stage of this hydrothermal activity. Distribution of Pliocene-Pleistocene basalt suggests that deep-seated basalt near the solids may be the ultimate heat source.

18381 **(PB—84-138908) Geothermal energy: abstracts of final reports arising from the first Energy Research and Development Programme of the CEC (Commission of the European Communities) (1975-1979).** Staroste, E. (Commission of the European Communities, Luxembourg). 1984. 140p. (EUR—8321). NTIS, PC E07/MF E07.

The following contents are included: regional exploration-reservoir assessment; Local exploration-drilling; temperature, heat flow, downhole instrumentation; geophysics; geochemistry; exploitation of geothermal resources; and hot dry rocks.

18382 **(USGS-OFR—82-104) Thermal springs in the Salmon River basin, central Idaho.** Young, H.W.; Lewis, R.E. (Geological Survey, Boise, ID (USA)). Feb 1982. 42p. USGS Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

The Salmon River basin within the study area occupies an area of approximately 13,000 square miles in central Idaho. Geologic units in the basin are igneous, sedimentary, and metamorphic rocks; however, granitic rocks of the Idaho batholith are predominant. Water from thermal springs ranges in temperature from 20.5° to 94.0° Celsius. The waters are slightly alkaline and are generally a sodium carbonate or bicarbonate type. Dissolved-solids concentrations are variable and range from 103 to 839 milligrams per liter. Estimated reservoir temperatures determined from the silicic acid-corrected silica, sodium-potassium-calcium, and sulfate-water isotope geothermometers range from 30° to 184° Celsius. Tritium concentrations in sampled thermal waters are near zero and indicate the waters are at least 100 years old. Stable-isotope data indicate it is unlikely that a single hot-water reservoir supplies hot springs in the basin. Thermal springs discharged at least 15,800 acre-feet of water in 1980. Associated convective heat flux is 2.7 x 10^7 calories per second.

18383 **(USGS-OFR—82-980) Integrated model of the shallow and deep hydrothermal systems in the East Mesa area, Imperial Valley, California.** Riney, T.D.; Pritchett, J.W.; Rice, L.F. (Systems, Science and Software, La Jolla, CA (USA)). 1982. 118p. USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Geological, geophysical, thermal, petrophysical and hydrological data available for the East Mesa hydrothermal system that are pertinent to the construction of a computer model of the natural flow of heat and fluid mass within the system are assembled and correlated. A conceptual model of the full system is developed and a subregion selected for quantitative modeling. By invoking the Boussinesq approximation, valid for describing the natural flow of heat and mass in a liquid hydrothermal system, it is found practical to carry computer simulations far enough in time to ensure that steady-state conditions are obtained. Initial calculations for an axisymmetric model approximating the system demonstrate that the vertical formation permeability of the deep East Mesa system must be very low (k/sub v/ ~ 0.25 to 0.5 md). Since subsurface temperature and surface heat flow data exhibit major deviations from the axisymmetric approximation, exploratory three-dimensional calculations are performed to assess the effects of various mechanisms

which might operate to produce such observed asymmetries. A three-dimensional model evolves from this iterative data synthesis and computer analysis which includes a hot fluid convective source distributed along a leaky fault radiating northward from the center of the hot spot and realistic variations in the reservoir formation properties.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 18380, 18382

18384 **(DOE/ET/27014—T7) Geochemical analyses, age dates, and flow-volume estimates for quaternary volcanic rocks, Southern Cascade Mountains, Washington.** Hammond, P.E.; Korosec, M.A. (Portland State Univ., OR (USA). Dept. of Earth Sciences; Washington Div. of Geology and Earth Resources, Olympia (USA)). Dec 1983. Contract AC07-79ET27014. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007662.

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Data collected over the last three years as part of a continuing study of the Quaternary volcanic rocks of the southern Cascade Mountains are presented. Whole-rock chemical analyses, selected trace element geochemistry, volume approximations, specific gravity determinations, and locations are provided for most of the 103 samples collected, and 21 radiometric age dates are included. In addition, partial information, including names and flow-volumes, are presented for 98 additional samples, collected for related studies. The study extends from the Columbia River north to the Cowlitz River and Goat Rocks Wilderness area, and from the Klickitat River west to the Puget-Willamette Trough. The volcanic rocks are all younger than 3 million years and consist primarily of tholeiitic and high-alumina basalts and basaltic-andesites erupted from numerous shield volcanoes and cinder cones. A few analyses of more silicic rocks, including hornblende and/or pyroxene andesites and dacites characteristic of the stratovolcanoes of the region, are also presented. However, systematic sampling of the stratovolcanoes in the study area, Mount Adams and Mount St. Helens, was not conducted. A map of the areal extent of Quaternary volcanic units and sample locations is included. It has been based on the 1:125,000 reconnaissance geologic map of the southern Cascade Range by Hammond (1980).

18385 **(DOE/ID/12063—T1) Sulfur gas geochemical detection of hydrothermal systems. Final report.** Rouse, G.E. (Earth Sciences, Inc., Golden, CO (USA)). 1984. Contract FC07-79ID12063. 31p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009369.

The purpose of this investigation was to determine whether a system of exploration using sulfur gases was capable of detecting convecting hydrothermal systems. Three surveying techniques were used at the Roosevelt Hot Springs KGRA in Utah. These were (a) a sniffing technique, capable of instantaneous determinations of sulfur gas concentration, (b) an accumulator technique, capable of integrating the sulfur gas emanations over a 30 day interval, and (c) a method of analyzing the soils for vaporous sulfur compounds. Because of limitations in the sniffer technique, only a limited amount of surveying was done with this method. The accumulator and soil sampling techniques were conducted on a 1000 foot grid at Roosevelt Hot Springs, and each sample site was visited three times during the spring of 1980. Thus, three soil samples and two accumulator samples were collected at each site. The results are shown as averages of three soil and two accumulator determinations of sulfur gas concentrations at each site. Soil surveys and accumulator surveys were conducted at two additional KGRA's which were chosen based on the state of knowledge of these hydrothermal systems and upon their differences from Roosevelt Hot Springs in an effort to show that the exploration methods would be effective in detecting geothermal reservoirs in general. The results at Roosevelt Hot Springs, Utah show that each of the three surveying methods was capable of detecting sulfur gas anomalies which can be interpreted to be related to the source at depth, based on resistivity mapping of that source, and also correlatable with major structural features of the area which are thought to be controlling the geometry of the geothermal reservoir. The results of the surveys at Roosevelt did not indicate that either the soil sampling technique or the accumulator technique was superior to the other.

18386 **(LBL—16672) Development and use of a high temperature downhole flowmeter for geothermal well logging.** Solbau, R.D.; Goranson, C.B.; Benson, S.M. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 8p. (CONF-831253—10). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008253.

From 9. workshop on geothermal reservoir engineering; Stanford, CA, USA (13 Dec 1983).

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The development and use of a high temperature (300°C) downhole flowmeter for geothermal well logging are discussed. The availability of the instrument gives the reservoir engineer a powerful tool for formation evaluation and studying wellbore dynamics. The instrument components, their function, and temperature limitations are discussed in detail. Several field examples of spinner log interpretation are also presented.

18387 **(USGS-OFR—82-844) Heat flow and sub-surface temperatures in the Great Valley, California.** Wang, J.; Munroe, R.J. (Geological Survey, Denver, CO (USA)). 1982. 102p. USGS Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

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The Great Valley of California is located between the Coastal Ranges and the Sierra Nevada and geologically is a structural trough with a thick sequence of sediments. Preliminary investigations of heat flow indicates that this region is characterized by a low-to-normal heat flow of 0.6 to 1.3 HFU. A number of shallow holes for water supply and deep holes for oil and gas exploration have been drilled. Temperature measurements were made in most of these holes. Unfortunately, core and drill cuttings were available from only a few holes for thermal conductivity measurements. Here, three new heat-flow values, a gradient map, and an isotherm map of temperatures at 200 meters are presented.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 19214

18388 **(LA—9984-T) Potential effects of hydrogen sulfide gas from geothermal energy conversion on two plant species native to northern New Mexico.** Gonzales, G.J. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 129p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84008370.

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Dry weight of topgrowth, water content of topgrowth, leaf nitrogen content, and leaf chlorophyll content were measured in well-watered, field-exposed little bluestem (Schizachyrium scoparium Nash.) and mountain brome (Bromus marginatus Nees.) plants fumigated with various mean levels of H_2S ranging from 0.05 to 3.58 ppM. The youngest fully expanded leaves were sampled for chlorophyll content after 60, 80, 100, and 140 and 60, 80, 120, and 140 h total of fumigation for little bluestem and mountain brome, respectively. All other responses were measured after 140 h total of fumigation. The plants received a 7-day fumigation-free period prior to the seventh week (140 h) of fumigations. Dry weight of little bluestem plants which received low concentrations of H_2S (0.11 ppM) increased by 94% of the control. Dry weight of little bluestem plants which received higher concentrations of H_2S (0.12 to 0.48 ppM) was reduced to the control level. At the highest H_2S concentration (2.39 ppM) dry weight of little bluestem was reduced by 44% of the control. Mountain brome was relatively unaffected at the different concentrations of H_2S until 3.58 ppM H_2S was received where dry weight was reduced by 37% of the control.

1507 By-products

18389 (UCID—20028) Recovery of platinum from concentrated sodium chloride brine by electrodeposition on vitreous carbon. Harrar, J.E.; Stephens, F.B. (Lawrence Livermore National Lab., CA (USA)). Jan 1984. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009084.

The voltammetric characteristics of Pt(II) and Pt(IV) have been examined at a vitreous carbon electrode in slightly acidic 3M (~ 15 wt %) NaCl solutions. Pt(IV) is reduced to Pt(II) at ~ 0 V and Pt(II) is reduced to Pt(0) at ~ -0.5 V vs Ag-AgCl. The rate of deposition of platinum metal at -0.5 V is very low on bare carbon, but increases as the coverage of platinum increases. The potential at which hydrogen is evolved in this medium is ~ -0.85 V. A technique has been tested for the removal of sub-part-per-million levels of platinum from the high-salinity brine by controlled-potential electrolysis using a reticulated, vitreous-carbon, flow-through electrode. However, at control potentials negative enough to begin to electrodeposit the platinum at a significant rate, simultaneous reduction of hydrogen ion reduces the current and energy efficiency to an unacceptable level.

1508 Geothermal Power Plants

18390 (DOE/ET/27163—T4) Baca geothermal demonstration project: PNM's overview of project objectives, plant design, project completion status, maintenance, storage, and marketing of equipment, site restoration, and project benefits. (Public Service Co. of New Mexico, Albuquerque (USA)). Apr 1983. Contract FC03-78ET27163. 46p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007769.

The overall goal of the Baca project was to demonstrate the reliability, economic feasibility, and environmental acceptablity of an electric generating plant powered by geothermal energy from a hot water resource. Because of the inability to develop an adequate steam supply for a late 1982 power plant start-up, the project closeout activities are included. (MHR)

1509 Geothermal Engineering

18391 (DOE/AL/10563—T18) Geothermal reservoir well stimulation program. Final program summary report. (Republic Geothermal, Inc., Santa Fe Springs, CA (USA)). Jan 1984. Contract AC04-79AL10563. 36p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008264.

Eight field experiments and the associated theoretical and laboratory work performed to develop the stimulation technology are described. A discussion of the pre-stimulation and post-stimulation data and their evaluation is provided for each experiment. Overall results have shown that stimulation is viable where adequate reservoirs are penetrated by wells encountering formation damage or locally tight formation zones. Seven of the eight stimulation experiments were at least technically successful in stimulating the wells. The two fracture treatments in East Mesa 58-30 more than doubled the producing rate of the previously marginal producer. The two fracture treatments at Raft River and the two at Baca were all successful in obtaining significant production from previously nonproductive intervals. However, these treatments failed to establish commercial production due to deficiencies in either fluid temperature or reservoir transmissivity. The Beowawe chemical stimulation treatment appears to have significantly improved the well's injectivity, but production data were not obtained because of well mechanical problems. The acid etching treatment in the well at the Geysers did not have any material effect on producing rate. Evaluations of the field experiments to date have suggested improvements in treatment design and treatment interval selection which offer substantial encouragement for future stimulation work.

17 WIND ENERGY

1704 Economics

REFER ALSO TO CITATION(S) 18396

18392 (LBL—15998) Analysis of the performance and cost effectiveness of nine small wind energy conversion systems funded by the DOE Small Grants Program. Kay, J. (Lawrence Berkeley Lab., CA (USA)). Apr 1982. Contract AC03-76SF00098. 133p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84008256.

Thesis.

The technical performance and cost effectiveness of nine small wind energy conversion systems (SWECS) are analyzed. An analytic framework with which to evaluate the systems is given, and each of the nine projects is reviewed, including project technical overviews, estimates of energy savings, and results of economic analysis. Technical, economic, and institutional barriers are summarized that are likely to inhibit widespread dissemination of SWECS technology. The systems range in cost from about $10,000 to nearly $50,000. Six systems generate electricity, two pump water, and one generates heat by hydraulic friction. (LEW)

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 18392

18393 (NP—4900814) Biennial summary, September 1981-August 1983. Nelson, V. (West Texas State Univ., Canyon (USA). Alternative Energy Inst.). Jan 1984. 13p. Alternative Energy Inst., West Texas State Univ., Box 248, Canyon, TX 79016.

The Alternative Energy Institute continued its program of evaluation of wind energy conversion systems, measurement of windspeeds, education and information. The establishment of the Wind Test Center adjacent to the campus was the most important accomplishment during the period. AEI now has the facilities for testing wind turbines for manufacturers and two units were installed by the end of August 1983. Space is available for 10 to 12 wind turbines. The cooperative agreement with the US Department of Agriculture, which began in 1976, continues to be beneficial to both groups. Four new wind turbines plus seven other wind turbines were evaluated. Two more wind turbines were not run during the period. Main results of the evaluation program are: Operating time is needed to obtain information on reliability and maintenance. Small changes in the rotor, such as blade pitch, can make large changes in power output and annual energy production. The wind measurement program is now in the fourth year, and within another two years, a good data base will be established for companies interested in wind farms and installation of large wind turbines. The results of the program is that the amount of energy available at hub heights of large wind turbines is larger than that predicted from data taken at National Weather Service stations. Personnel from AEI have given 20 local and regional presentations, four seminars and four presentations at the international level. AEI is the main source in Texas for information on wind energy as 500 requests are answered each year. Over 3000 pamphlets, brochures, and reports have been sent to technical people and the public. AEI and USDA hosted Wind Energy Expo '82 and National Conference of the American Wind Energy Association. The highlight of the conference was the tour to view the operating wind turbines at the USDA Wind Energy Laboratory.

18394 (PNL—4914) Simulation of winds as seen by a rotating vertical axis wind turbine blade. George, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 52p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009033.

The objective of this report is to provide turbulent wind analyses relevant to the design and testing of Vertical Axis Wind Turbines (VAWT). A technique was developed for utilizing high-speed turbulence wind data from a line of seven anemometers at a

single level to simulate the wind seen by a rotating VAWT blade. Twelve data cases, representing a range of wind speeds and stability classes, were selected from the large volume of data available from the Clayton, New Mexico, Vertical Plane Array (VPA) project. Simulations were run of the rotationally sampled wind speed relative to the earth, as well as the tangential and radial wind speeds, which are relative to the rotating wind turbine blade. Spectral analysis is used to compare and assess wind simulations from the different wind regimes, as well as from alternate wind measurement techniques. The variance in the wind speed at frequencies at or above the blade rotation rate is computed for all cases, and is used to quantitatively compare the VAWT simulations with Horizontal Axis Wind Turbine (HAWT) simulations. Qualitative comparisons are also made with direct wind measurements from a VAWT blade.

18395 **(SAND—82-2534) Comparison of finite element predictions and experimental data for the forced response of the DOE 100 kW vertical axis wind turbine.** Lobitz, D.W.; Sullivan, W.N. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007977.

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A specialized finite element capability has been developed to predict dynamic structural response of the vertical axis wind turbine (VAWT). This report is concerned with evaluating this finite element analysis technique. To achieve this, several types of experimental data taken from the DOE 100 kW rotor are compared with predictions. These data include parked rotor natural frequencies, very low wind centrifugal and gravitational load response, and vibratory response from wind loads covering the rotor operational spectrum. Generally, the agreement between theory and experiment is very satisfactory. It is concluded that the analysis package is suitable for engineering design. Shortcomings observed in modeling accuracy are believed to be due primarily to inadequacies in blade aerodynamic load calculations.

18396 **Technical and economic progress in the development of wind power.** Divone, L.V.; Luther, E. (Office of Solar Electric Technologies, U.S. DOE). *International Symposium on Wind Energy Systems, Proceedings;* **1**: 119-130(Sep 1982). (CONF-820922—).

From 4. international symposium on wind energy systems; Stockholm, Sweden (21 Sep 1982).

At prior workshops, the authors have presented papers describing the U.S. programme of research and development in the field of wind energy. On this occasion, a slightly different approach is taken. Other papers at the 4th International Symposium on Wind Energy Systems present the status to date of both DOE and privately developed wind systems. Although the authors comment on the DOE programme and its present direction, they concentrate on the technological and economic status and progress of wind power as a whole and present subjective opinions on both what is known and what is not yet known.

18397 **The Department of Energy (DOE) research program in structural analysis of vertical axis wind turbines.** Sullivan, W.N. (Sandia National Laboratories). *International Symposium on Wind Energy Systems, Proceedings;* **1**: 75-92(Sep 1982). (CONF-820922—). Contract AC04-76DP00789.

From 4. international symposium on wind energy systems; Stockholm, Sweden (21 Sep 1982).

The Darrieus-type Vertical Axis Wind Turbine (VAWT) presents a variety of unusual structural problems to designers. The level of understanding of these structural problems governs, to a large degree, the success or failure of today's rotor designs. This paper presents a survey of the technology available for rotor structural design with emphasis on the DOE research program now underway. Itemizations are included of the major structural issues unique to the VAWT along with discussion of available analysis techniques for each problem area. It is concluded that tools are available to at least approximately address the most important problems. However, experimental data for confirmation is rather limited in terms of volume and the range of rotor configurations tested.

18398 **Meteorological field measurements at potential and actual wind turbine sites.** Renne, D.S.; Berwager, S.D.; Hadley, D.L.; Sandusky, W.F. (Pacific Northwest Laboratory). *International Symposium on Wind Energy Systems, Proceedings;* **1**: 141-154(Sep 1982). (CONF-820922—).

From 4. international symposium on wind energy systems; Stockholm, Sweden (21 Sep 1982).

Since 1976 the U.S. Department of Energy (DOE) has sponsored field measurement programs at a number of sites around the United States that appear promising for wind energy utilization. From time to time a site from this group has been chosen for installation of a large wind turbine for field testing. After the installation, the wind measurement activities are expanded to record wind data from the meteorological tower as well as turbine performance data simultaneously. This measurement program has produced information, not only on wind characteristics in a variety of windy locations, but also on procedures of obtaining reliable and accurate wind measurements in harsh environments. In addition, with the availability of turbine data at some of these sites, this program has provided insight into the most appropriate measurement strategies at a potential wind turbine site so that estimates of machine performance and potential hazards to the machine can be obtained efficiently. This paper summarizes these field measurement experiences. Statistical analysis of high-frequency data collected at sites with wind turbines have indicated that time-averaged sampling is preferable over instantaneous samples. Although the instantaneous samples are adequate for climatological representativeness, time-averaged samples are more realistic for simulating turbine operations and for correlating wind speed measurements at the tower with turbine power output.

20 ELECTRIC POWER ENGINEERING

18399 **(TVA/OP/PSO—83/1) Safety manual.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Power System Operations). May 1983. 148p. NTIS, PC A07/MF A01. Order Number DE84900734.

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This manual, dedicated to that effort, has been prepared to help TVA employees perform their work safely. The information in this manual is the result of the experience and observations of many people in the Division of Power System Operations (PSO). As such, the manual offers a PSO employee the benefit of that accumulated knowledge of safe working in the Division.

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 17966, 18031, 18033, 18718

18400 **(DOE/NASA/0030—80/4) Cogeneration technology alternatives study (CTAS) United Technologies Corporation final report. Volume IV. Heat sources, balance of plant and auxiliary systems.** (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Jan 1980. Contract AI21-77ET13111. 295p. (NASA-CR—159762-Vol.4; UTC-FCR—1333-Vol.4). NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84009069.

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The Cogeneration Technology Alternatives Study (CTAS) provides data and information in the area of advanced energy conversion systems for industrial cogeneration application in the 1985 to 2000 time period. Six current and thirty-one advanced energy conversion systems were defined and combined with appropriate balance-of-plant equipment. Twenty-six industrial processes were selected from among the high energy consuming industries to serve as a frame work for the study. Each conversion system was analyzed as a cogenerator with each industrial plant. Fuel consumption, costs, and environmental instrusion were evaluated and compared to corresponding traditional values. Various cogeneration strategies were analyzed and both topping and bottoming (using industrial by-product heat) applications were included. The advanced energy conversion technologies indicated reduced fuel consumption, costs, and emissions. Typically fuel energy savings of 10 to 25 percent were predicted compared to traditional on-site furnaces and

utility electricity. With the variety of industrial requirements, each advanced technology had attractive applications. Overall, fuel cells indicated the greatest fuel energy savings and emission reductions. Gas turbines and combined cycles indicted high overall annual cost savings. Steam turbines and gas turbines produced high estimated returns. In some applications, diesels were most efficient. The advanced technologies used coal-derived fuels, or coal with advanced fluid bed combustion or on-site gasification systems. This volume presents heat source, balance-of-plant, and plant design information developed by Bechtel National, Incorporated; heat storage data developed by Rocket Research Company; and heat pump information developed by Power Systems Division United Technologies with the advice of Westinghouse Electric Company.

18401 **(ESC—26) The perception of energy risks: a national investigation into suppositions, attitudes, standards and behaviour with regard to generation of electricity by coal, uranium and wind.** Midden, C.J.H.; Daamen, D.D.L.; Verplanken, B. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Sep 1983. 434p. (In Dutch). Stichting Energieonderzoek Centrum Nederland (ECN), Energie Studie Centrum, Petten.

A survey on the perception in the Netherlands of 3 options to generate electricity, coal, uranium and wind, has been given. Special attention has been paid to the perception and acceptance of the risks of these options. The questionnaire has been constructed according to a modified Fishbein-model and was completed by 1112 respondents. Attention has been paid to the following questions: what is the distribution of attitudes towards the application of coal, uranium and wind; how are behavioral intentions determined by attitudes and normative influences; what is the relevance of factors like involvement with the subject, the perceived personal effectivity to influence collective decisions to use coal, uranium or wind, the level of information about these energy systems, the ways to obtain this information; are there people who feel threatened by the use of these energy systems; what are the preferences and expectations with respect to the use of energy options in the future; are there differences in risk perception between various population-categories. The presentation of empirical results is preceded by a review of recent literature on perception of (energy) risks and the report concludes with an elaborate discussion of the results and suggestions for energy policy and research. (In Dutch)

18402 **(ESC-WR—83-22) Competitiveness of advanced coal power plants. Electricity production cost comparison of coal-fired power plants as used in the IEA/ETSAP project.** Kram, T. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Sep 1983. 24p. Stichting Energieonderzoek Centrum Nederland (ECN), Energie Studie Centrum, Petten.

Besides the conventional, commercially available design with pulverized coal boiler, steam turbine and flue gas desulfurization, several new designs are studied in R, D and D programs. The three types introduced in the Energy System Data base compiled for the Netherlands during the IEA/ETSAP project are compared with regard to electricity production cost. Under various assumptions about interest rate and coal prices, the chances of new designs to become economically attractive options for electricity generation are assessed. The following conclusion emerges from the analyses: both the Advanced Combined Cycle (ACC) and the Magnetohydrodynamic (MHD) power plants have good chances to become economically attractive options for future electricity generation, compared to the conventional pulverized coal plant. (Available from ECN, PO Box 1, NL-1755 ZG Petten, The Netherlands).

18403 **(NP—4770199) Influence of cooling jets and mixing zone geometry on the temperature - profile development in gas-turbine combustion chambers.** Elbahar, O. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). 28 Apr 1982. 140p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770199.

The theoretical description of the influence of cooling jets and mixing zone geometry on the temperature profit at the outlet of gas turbine combustion chamber is the main task of the present thesis. Direct application of the mathematical models which are developed here and which have to be confirmed by comparing mathematical results with measurements is the most important issue. The models should be able to describe the influence of cooling jets when arranged either on two sides; staggered or in several rows, as well as the cross-section change of the mixing zone and the profiling of temperature and velocity at the mixing zone inlet. The task was therefore to utilize these experimental observations in order to develop a relatively simple practice-oriented two-dimensional model in order to describe the mixing processes and to compare the mathematical results with the correlations used in practice up to now. For this purpose it is necessary to represent each row of cooling jets by a slot whereby the slots have the same total area. The two-dimensional time averaged turbulent form of the continuity equation is solved by means of the difference equations using an adequate turbulent model.

18404 **(NP—4770200) Studies with vaned diffusors of a high-duty radial compressors.** Jansen, M. (Hannover Univ. (Germany, F.R.). Fakultaet fuer Maschinenwesen). 19 Jan 1982. 189p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770200.

In recent years great progress was made on the sector of radial diffuser research. This is especially true of the description of the flow in the rotor and the vaneless diffusor. A number of studies were dedicated to vaned diffusors. Theoretic and experimental investigations made with this component are very extensive as the flow is dynamic especially in the diffusor inlet area; even if vanes are twisted one has to reckon with flow separations. Flow mechanisms need to be investigated especially in the inlet area of the vaned diffusor, investigation is also needed for the reciprocal action between the systems inlet, rotor, diffusor and compressor outlet. However the diffusor inlet flow has a vital influence on the operation of the vaned diffusor, it therefore needs to be very well adapted to the flow conditions. This thesis means to make a contribution to the understanding the flow processes in a vaned diffusor of a high-duty radial compressor and to the understanding of the influence of an unequal entrance flow on the operation of a diffusor.

18405 **(NP—4770203) Measurements of shaft oscillations in turbomachinery systems with regard to the phase angle.** Ihl Dausend, C.F. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 30 Jul 1982. 216p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84770203.

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If there is no external influence, the smooth running of a turborotor only depends on the state of the rotor. Therefore oscillation measurement can be performed on the machine to get information on the state of the shaft. The common measurements of bearing oscillations are more and more replaced by a direct measurement of the shaft oscillations. To continue earlier work, an existing rotor test system has been extended, in order to account also for influences due to the turbine foundation. The bearing brackets which support the bearing bushings have been aligned with respect to minimum canting. A test shaft with three bearings is balanced by the method of influence numbers using a table-top computer code. In the shaft oscillation studies, the phase angle has been measured in addition to the large semi-axis of the generally elliptical wave orbit. For this purpose a reference signal generator has been developed, which allows also to determine the phase shifts within the waveoscillation measuring chain between the trandurcer and the monitor. As is shown by the results, changes in the balancing state of the shaft can be obtained by calculating the differences between the phase changes in the respective measuring planes. To obtain the plane of unbalance is an unambigious way, the bearing bracket oscillation amplitudes and phases have to be determined in different measuring planes in addition to maximum amplitude of the shaft.

18406 **(NP—4770204) Contribution to the study of the influence of temperature-field manipulations on the thermomechanical stresses in turbine discs.** Erhard, W. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 27 Jul 1982. 134p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770204.

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A better efficiency of gas turbines can be obtained by higher inlet temperatures and pressures, resulting in an essentially larger load for the turbine rotors. Here the rotor disc is considered in more detail, using a special computer code (TALFS) based on the method of finite elements. With this code the thermal boundary conditions of the rotor discs for axial turbines can be calculated together with the stationary temperature distribution. By the program TROT, also the non-stationary behaviour can be studied. Relatively prcise stability calculations for realistic turbine discs with complex geometrical shape and load distribution can also be done with finite element codes. For such calculations, the SIGMAL-code is available. The mechanical boundary conditions can be defined more easy and with a higher precision than the thermal boundary conditions. As an example the influence of different cooling parameters has been studied with respect to the stationary and non-stationary temperature distribution and the related mechanical loading for the case of the rotor of a small gas turbine. For this purpose an experimental setup has been built to study the thermal boundary conditions with many components developed in the lab, e.g. an optoelectronical transducer to transfer the temperature data from the rotating to the stationary system, software and hardware for data handling and graphical output using a microcomputer, a radiation temperature measuring system as well as other equipment.

18407 **(PB—84-128966) Long-term optimum performance/corrosion tests of combustion modifications for utility boilers, host site: Louisville Gas and Electric Company, Mill Creek No. 3.** Natanson, P.S. (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Jan 1984. 282p. NTIS, PC A13/MF A01.

Corrosion in utility boilers, as possibly affected by combustion modifications (CM) for decreased NOx emissions, was studied at large furnaces burning high sulfur coal. Under the first part of this program, each boiler was characterized to determine the short term effects of the various combustion modifications and controls on boiler operation, and emissions. Later, a Level 1 environmental assessment (EA) of boiler operation was performed, as well as tests to measure corrosion rate within the furnace, and two 30-day continuous emission monitoring tests. This report discusses the tests performed on Boiler No. 3 at Louisville Gas and Electric (LGandE) Company's Mill Creek Generating Station in Louisville, Kentucky.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 17981, 17982, 17993, 18030, 18038, 19026, 19027, 19028, 19072, 19125

18408 **(DOE/PC/60265—T1) Development of process for combined NO/sub x/SO/sub x/ control. Technical progress report for February 1984.** (Science Applications, Inc., San Diego, CA (USA)). 14 Mar 1984. Contract AC22-83PC60265. 4p. NTIS, PC A02/MF A01. Order Number DE84008265.

Adsorption/destruction tests were performed on some of the iron- and copper-exchanged synthetic mordenite zeolites using the SAI adsorption test apparatus and 12-in. deep test beds. The iron-exchanged zeolite adsorbents were prepared using three different anions, $Fe(II)SO_4$, $FeCl_3$, $Fe(NO_3)_3$, and $CuSO_4$. The iron and copper contents of the samples were significantly different. The test conditions and test results are presented in tabular form. It is clear from the test results that the cation location in the zeolite is much more important than the total cation loading. The iron-exchanged zeolite (FeZ) containing 8.4 wt % iron, prepared by iron-exchange and impregnation using iron (III) in a nitrate solution, was much less effective than that containing 3.6 wt % iron prepared from iron-exchange using Fe(II) and sulfate as the anion. The iron-zeolite prepared using Fe(III) as the chloride gave somewhat less than proportional results compared with the FeZ prepared from the sulfate. The copper-exchanged zeolite contained nearly an equivalent amount of cation as the FeZ prepared from the sulfate although it performed slightly less efficiently for removing SO_2 and considerably less for NO/sub x/ destruction. 1 figure, 1 table.

18409 **(PB—84-140268) Documentation of the database: Wisconsin power plant impact study.** Shacham, S.; Chesters, G.; McLellan, H. (Wisconsin Univ., Madison (USA). Water Resources Center). Jan 1984. 400p. NTIS, PC A17/MF A01.

This volume describes the data base of the first phase of the Wisconsin power plant impact study. Data were collected by investigators at the University of Wisconsin-Madison from 1971 to 1978 during their study of the Columbia Generating Station near Portage, Wisconsin. This volume serves as a communications link within the Wisconsin power plant impact study and as a means of making these data available to outside users for further analysis and synthesis. This volume provides a brief description of the data sets; a more extensive documentation of these sets are being published by the U.S. Environmental Protection Agency. The number accompanying each data set is unique and serves to identify a data set within the data base.

18410 **(PB—84-141563) Fabric filter system study: third annual report. Report for September 1979-October 1980.** Ladd, K.L.; Chambers, R.L.; Plunk, O.C.; Kunka, S.L. (Southwestern Public Service Co., Amarillo, TX (USA)). Jan 1984. 52p. NTIS, PC A04/MF A01.

The report gives results of the third year of operation (ended October 1, 1980) of a fabric filter installed by Southwestern Public Service Co. on its Harrington Station Unit 2 coal-fired boiler in Amarillo, TX. Results of the emissions testing program demonstrated that the 1971 EPA standard of 1.2 lb SO2/million Btu can be met by burning coal with a sulfur content lower than 0.5 percent. Particulate emissions were less than the 0.03 lb/million Btu standard in all four of the particulate emissions tests. Fabric studies to date show that several fabrics have a potential 3-year baglife. The operation and maintenance cost reported for the third year of study is $434,800, or $1.21/yr/kW. Data analysis continued through the third year. Information on boiler O2 levels, air-to-cloth ratio, temperature, system pressure drop, and boiler load is being logged continuously.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 19125

18411 **(BNL—51719) Semiannual report on (1) superconducting power transmission system development and (2) cable insulation development, October 1, 1982-March 31, 1983.** (Brookhaven National Lab., Upton, NY (USA)). 14 Sep 1983. Contract AC02-76CH00016. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007805.

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Object is to develop an underground superconducting power transmission system which is economical and technically attractive to the utility industry. The materials work covers the development and testing of suitable superconductors and dielectric insulation. The laboratory work has now been extended to an outside test facility which represents an intermediate step between the laboratory scale and a full-scale system. The facility allows cables several hundred feet long to be tested under realistic conditions. Three operating runs of about 2 weeks duration each have been accomplished. The 60 Hz steady state performance of the cables under rated conditions has been thoroughly explored. Over-voltage endurance tests and emergency level current tests have been made.

18412 **(DOE/IE—0001) Report on the Electric Power System disturbance of December 22, 1982, affecting the western United States.** (USDOE Assistant Secretary for International Affairs and Energy Emergencies, Washington, DC). Feb 1984. 46p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007764.

A severe Pacific storm struck central California on Wednesday, December 22, 1982. At 4:29 PM, 90 mph winds caused the failure of a transmission tower north of Pacific Gas and Electric Company's (PG and E) Tesla substantion, whic resulted in the loss of operation of both of the 500 kilovolt (kV) transmission lines of

the Pacific AC Intertie. The power flow on five lower voltage transmission lines which cross under the 500 kV lines was also disrupted. This event led to the interruption of electric service to over five million customers (mostly in California) representing over 12,000 megawatts (MW) of load. No utility system was completely blacked out, and service was restored to nearly all customers within 3.5 hours of the initial event. This review was conducted for the purpose of illustrating the processes, trends, and issues that may be of concern to federal officials, members of Congress, and others within and outside the electric power industry. This DOE staff report is based on information obtained from a related report prepared by the utilities in the Western Systems Coordinating Council describing the disturbance as well as the restoration process and recommending corrective actions; discussions with technical personnel at WSCC headquarters and at five of the utilities involved in the disturbance and subsequent reports prepared by individual utilities.

18413 **(EPRI-EL—3295) Mitigation of geomagnetically induced and dc stray currents. Final report.** Kappenman, J.G. (Minnesota Power and Light Co., Duluth (USA)). Dec 1983. 186p. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

This report primarily describes several approaches to mitigate the effects of Geomagnetic Induced Currents (GIC) and dc stray currents in power systems; the engineering and design considerations for a neutral capacitor blocking device; and development and testing of a prototype device of this type. Modeling of the power system for computation of GIC are described. Results from three field tests, for documenting the effects of GIC by injecting direct current (dc) into the neutrals of the transformers, are presented. Several mitigation concepts are discussed and evaluated. The concept of blocking GIC and dc stray currents by a neutral capacitor is addressed in detail. The development and testing of the prototype blocking device is described. The technical requirements and specifications for the application of these devices are also included. A perspective on the economics of GIC mitigation is included. The effect of GIC and dc stray currents on HVdc converter operation, supported by computer simulations, is also discussed.

18414 **(EPRI-EL—3306) Workshop proceedings: transmission system reliability methods.** (Power Technologies, Inc., Schenectady, NY (USA)). Dec 1983. 393p. (CONF-8210250—). Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

From Workshop on transmission system reliability methods; Washington, DC, USA (28 Oct 1982).

The workshop was held to review before a representative group of electric utility engineers (1) the results and significant findings of the recently completed EPRI RP1530-1, Transmission System Reliability Methods;(2) the capabilities of a prototype computer program developed in the project; and (3) the applications of the program in the power system planning and operation areas.

18415 **(NP—4770168) Computations of idealized high-voltage interconnected networks in special consideration of densely populated areas.** Mukherjee, A. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Elektrotechnik). 24 Mar 1982. 152p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770168.

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In this report finite homogeneous networks were conceptualized and described mathematically in a way that differs from former considerations of homogeneous networks. These finite networks are characterized by varying power densities and node connections in parts, as they are present in real high voltage networks. This allows an accurate modelling of practical conditions. Two types of idealized networks were assumed: (A) With a higher input into clustered nodes in densely populated areas while keeping the nodes evenly spaced. (B) With a closer node spacing in densely populated areas while keeping the iput identical in all nodes. From the results, the relations between the parameters of the densely populated areas and the amount of the node short-circuit currents could be worked out. Furthermore, with the some computation technique, the efficiency of the collector mains division could be determined with respect to a short-circuit current reduction. This technique is often applied in high-voltage networks for short-circuit current reduction.

18416 **(NP—4770170) Contribution to calculation of ferroresonance phenomena in power supply networks.** Kegel, R. (Hochschule der Bundeswehr, Hamburg (Germany, F.R.). Fachbereich Elektrotechnik). 18 Aug 1981. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770170.

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Starting from a simple series resonance circuit the basic physical relations are explained, which are relevant for relaxation oscillations. A simulation shows the influence of various parameters in more detail. A numerical simulation method has been developed and tested by a series resonance circuit model, which is a rather simple scheme compared with practical power transmission networks. Good agreement is obtained for the experimental and numerical results. This numerical scheme is then extended to describe also multi-phase networks. In most cases the choke is replaced by a three-phase transformer; this situation is described by an analytical model. As an example a special network is calculated with an open circuit transformer with free star point connected to a switch system by a cable.

18417 **(NP—4770197) Use of a parallel processor system for the investigation of dynamic processes in power systems.** Schmidt, K. (Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 9 Jul 1982. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770197.

In this paper the possibility of using a parallel processor system for simulation calculations (of electromechanical transient phenomena in electrical power transmission networks) is investigated from the point of view of short computing times at tolerable cost. The studies were made with a parallel processor developed by Siemens (SMS 201). Each module processor simulates a node of the network (bus) together with its environment. This assignment of node and module porcessor allows the application of an effective method of integrating the machine equations. All of the investigations have been performed using a model network consisting of 16 nodes, 10 generators and 18 lines according to a PREAG proposition. The influence of the integration step width and of the integration accuracy was studied. Comparisons of computing times for different mathematical methods showed that if the Runge-Kutta integration is used in combination with fictive generators for simulation of the load nodes the best results were obtained. If the computing time is compared with that of a serial control computer (Siemens 330 R30) it is shown that even for a small network with only 16 nodes the parallel processor is faster by a factor of 5. As a result of a theoretical comparison with a 16 bit microprocessor a further increase in speed by a factor of 4 may be expected.

18418 **(NP—4770198) Transient frequences and voltages in interconnected electric networks.** Heilemann, F. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik und Dampfkesselwesen). 14 Mar 1983. 185p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84770198.

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In this paper the individual components of an electric power supply system are analyzed and the structure of a dynamic network model is described, which was realized in the form of a modular simulation program system for the calculation of transient operating conditions in electric interconnections. It is started from symmetrical operating conditions at three-phase current transmission, a unipolar representation of the electric transmission system therefore being sufficient. The mathematical description of the synchronous machines is done by means of the two-axis theory. With respect to the slow equalizing processes for oscillations to be calculated some simplifications may be made reducing on one hand the number of required differential equations and allowing on the other to use larger integration steps in the simulation calculations. The electric consumer subsystems are represented accounting for the static and dynamic dependence on voltage and frequency of the active and reactive power. In order to determine these dependences numerous measurements in various networks were made in connection with

this paper. Concerning the turbine control loop simple models of the speed governor, the control valves and the steam turbine are used. A simplified model of the Western European interconnection is developed consisting of 60 active network nodes and 108 substitute transmission lines. At each node a dynamically simulated power plant unit operates including its control devices and a consumer subsystem. By simulating various incidental events an insight may be given into the total dynamics of the European interconnection showing how interferences - e.g. power plant outages or failures of important transmission lines - will propagate and in which way system oscillations will occur in the total network.

18419 **(NP—4770202) Harmonic oscillations of the earth fault residual current in the compensated three-phase supply network.** Fischer, M. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Energieuebertragung und Hochspannungstechnik). 30 Nov 1981. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770202.

In this paper a procedure is described to calculate the fundamental frequency and the higher harmonics of the earth fault residual current with high precision. The method allows to take into account also generators, transformers, lines, loads, earth fault coils, series-tuned harmonic resonance circuits, and circuits to compensate the higher harmonics of the earth fault residual currents. The calculation of the earth fault residual current in a mesh network is only feasible by numerical methods. Here a FORTRAN program is presented to evaluate these parameters.

18420 **(NP—4770205) Influence of the final transmission capability of a high voltage network on reliability considerations of electric power supply systems.** Lehr, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 5 Feb 1982. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84770205.

First a model is described for the components of a restricted electric power supply system, followed by an analysis of the reliability and the transmission characteristics of the network. A new characteristic parameter is deduced which is a quantitative measure of the transmission capability of the network, formulated in the framework of reliability theory. After a critical discussion, a method is presented to determine this parameter, which is based on a fast identifiation of the lines and knots endangered by power plant failures. The precision and the applicability of the method for larger systems is tested by model calculations.

18421 **Technology development for advanced concepts in gas-insulated power transformers.** McNutt, W.J.; Rathbun, W.H.; Slocik, J.P.; Vora, J.P. (General Electric Co.). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **PAS-101**: No. 7, 2171-2177(Jul 1982).

A new concept for a compact, gas-insulated power transformer employing sheet wound aluminum coils with polymeric film insulation and separate sealed cooling system is described. A design comparison is given to illustrate the potential benefits it offers in terms of lighter weight, smaller dimensions, higher efficiency, and less audible noise than a conventional transformer with an oil/cellulose insulation system. The technological challenges which must be overcome before this concept can be implemented are outlined in the paper and progress which has been made toward development of a complete design practice is discussed.

18422 **Design and performance characteristics of gas-vapor transformers.** Moore, C.L.; Mitchell, G.F. Jr. (Westinghouse). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **PAS-101**: No. 7, 2167-2170(Jul 1982).

This paper presents the development of design data and lists the performance characteristics of several gas-vapor transformers designed, manufactured and tested by Westinghouse Medium Power Transformer Div., and now in service on a utility system.

18423 **The effects of reduced voltages on the efficiency of electric loads.** Chen, M.S.; Fitzer, J.; Shoults, R.; Songster, H. (University of Texas). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **PAS-101**: No. 7, 2158-2166(Jul 1982).

The paper reports the results from Phase I of Electric Power Research Institute RP1419 and describes the efficiency of important power system loads as a function of voltage. A wide variety of loads have been tested at seven input voltages ranging 100/200 to 126/252 volts, and a methodology has been developed to estimate distribution system efficiency as it relates to the operating level of voltage.

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18424 **(NUREG—0020-Vol.7-No.12) Licensed operating reactors. Status summary report, data as of November 30, 1983.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Feb 1984. 378p. NTIS, PC A17/MF A01 - GPO. Order Number DE84900817.

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This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States. The percentage computations, Items 20 through 24 in Section 2, the vendor capacity factors on Pages 1-7, and actual vs. potential energy production on Page 1-2 are computed using actual data for the period of consideration. The percentages listed in power generation on Page 1-2 are computed as an arithmetic average. The factors for the life-span of each unit (the Cumulative column) are reported by the utility and are not entirely re-computed by NRC. Utility power production data are checked for consistency with previously submitted statistics. It is hoped this status report proves informative and helpful to all agencies and individuals interested in analyzing trends in the nuclear industry which might have safety implications, or in maintaining an awareness of the US energy situation as a whole.

18425 **(NUREG—0020-Vol.8-No.1) Licensed operating reactors. Status summary report, data as of December 31, 1983.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Feb 1984. 394p. NTIS, PC A17/MF A01 - GPO. Order Number DE84900669.

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This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States. The percentage computations, Items 20 through 24 in Section 2, the vendor capacity factors on Pages 1-7, and actual vs. potential energy production on Page 1-2 are computed using actual data for the period of consideration. The percentages listed in power generation on Page 1-2 are computed as an arithmetic average. The factors for the life-span of each unit (the Cumulative column) are reported by the utility and are not entirely re-computed by NRC. Utility power production data are checked for consistency with previously submitted statistics. It is hoped this status report proves informative and helpful to all agencies and individuals interested in analyzing trends in the nuclear industry which might have safety implications, or in maintaining an awareness of the US energy situation as a whole.

18426 (NUREG/CP—0041-Vol.3, pp 68-77) **Survey of foreign reactor operator qualification, training, and staffing requirements.** Au, M.L.; Merschoff, E.W. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

NUREG-0863, Survey of Foreign Reactor Operator Qualification, Training, and Staffing Requirements was published by the Office of Nuclear Regulatory Research in May 1982. It was compiled in an effort to provide the Commission with the information needed to place various proposed changes to the regulations in the areas of qualifications, training, and staffing in perspective with respect to the practices of other countries. These changes to the regulations include revisions to 10 CFR Part 55, which would upgrade education, training certification, and requalification requirements; a revision to 10 CFR 50.54, which would upgrade CFR 50.34 based on the issues discussed in NUREG-0737, Clarification of TMI Action Plan Requirements. The questionnaire was developed to request detailed information in five areas, shift staffing requirements, eligibility requirements for operators, operator training program requirements, initial operator's license or certification requirements, and operator retraining requirements. It was sent to the regulatory authorities in Argentina, Belgium, Brazil, Canada, Finland, France, Federal Republic of Germany, India, Italy, Japan, Korea, Mexico, the Netherlands, Spain, Sweden, Switzerland, Taiwan, and the United Kingdom. The results are summarized in this report.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 18137, 18145, 18200, 18204, 18220, 18222, 18508, 18513, 18514, 18522, 18524, 18525, 18526, 18528, 18530, 18531, 18536, 18537, 18538, 18542, 18548, 18549, 18554, 18555, 18563, 18564, 18575, 18577, 18578, 18579, 18580, 18581, 18582, 18586, 18587, 18588, 18589, 18590, 18591, 18592, 18593, 18596, 18597, 18598, 18599, 18600, 18601, 18602, 18608, 18609, 18614, 18615, 18617, 18618, 18621, 18622, 18625, 18627, 18628

18427 (GEAP—25447-2) **Barrier fuel lead test assemblies: second cycle post-irradiation examination.** Thompson, J.R. (General Electric Co., San Jose, CA (USA)). Dec 1983. Contract AC02-77ET34001. 194p. NTIS (US Sales Only), PC A09/MF A01; GPO Dep. Order Number DE84008005.

Four lead test assemblies (LTAs) with barrier fuel were fabricated and inserted for irradiation into the core of the Quad Cities Nuclear Power Station, Unit 1. Each of the four LTAs had a different barrier cladding: Cu-barrier plated onto etched Zircaloy; Cu-barrier plated onto oxidized Zircaloy; Zr-liner (crystal bar zirconium) co-reduced with Zircaloy; and Zr-liner (low oxygen sponge zirconium) co-reduced with Zircaloy. This report describes the second cycle post-irradiation examination of the LTAs after 22.6 MWd/kg U bundle average exposure. The two Zr-liner LTAs were given an overall visual inspection after the second cycle irradiation. The two Zr-liner LTAs were then disassembled and ten selected fuel rods (five from each assembly) were given detailed inspections. In addition to a visual inspection, the nondestructive examination included length measurements, profilometry, ultrasonic and eddy current evaluation.

18428 (IWGFPT—1) **Pellet cladding interaction for water reactors. Summary report.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Fuel Performance and Technology for Water Reactors). Oct 1977. 368p. (CONF-7706133—). NTIS (US Sales Only), PC A16. Order Number DE84900849.

From IAEA specialists meeting; Vienna, Austria (27 Jun 1977).

Paper copy only, copy does not permit microfiche production.

Papers presented at this conference discussed PCI failure experience and observations; mechanisms of PCI failure; cladding and fuel characteristics with respect to PCI behavior; fuel pin modelling with respect to PCI behavior; and ways of avoiding PCI defects.

18429 (NUREG—0887-Suppl.4) **Safety Evaluation Report related to the operation of Perry Nuclear Power Plant, Units 1 and 2, (Docket Nos. 50-440 and 50-441).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Feb 1984. 144p. NTIS, PC A07/MF A01 - GPO $5.50. Order Number DE84900784.

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Supplement No. 4 to the Safety Evaluation Report on the application filed by the Cleveland Electric Illuminating Company on behalf of itself and as agent for the Duquesne Light Company, the Ohio Edison Company, the Pennsylvania Power Company, and the Toledo Edison Company (the Central Area Power Coordination Group or CAPCO), as applicants and owners, for a license to operate the Perry Nuclear Power Plant, Units 1 and 2 (Docket Nos. 50-440 and 50-441), has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is located in Lake County, Ohio. This supplement reports the status of certain issues that had not been resolved at the time of publication of the Safety Evaluation Report and Supplement Nos. 1, 2 and 3 to that report.

18430 (NUREG/CP—0041-Vol.1, pp 227-231) **Experimental data for nonequilibrium post-CHF heat transfer in a vertical tube.** Evans, D.; Webb, S.; Chen, J.C.; Neti, S. (Lehigh Univ., Bethlehem, PA). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

In post-CHF convective boiling, under both blowdown and reflood conditions of nuclear safety concern, one often finds that wall heat flux, wall temperature, fluid equilibrium quality, and the local heat transfer coefficient all vary with axial position. A number of experimental investigations have reported data for the axial variations of these parameters. However, to improve our capability for modeling post-CHF heat transfer, one needs to also know the axial variation of fluid actual quality and vapor superheat. A program at Lehigh University under the sponsorship of the US NRC has attempted to obtain experimental measurements of the nonequilibrium vapor superheat and fluid actual qualities for post-CHF boiling heat transfer in a vertical tube.

18431 (NUREG/CP—0041-Vol.3, pp 181-192) **Torsional ultrasonic technique for LWR liquid level measurement.** Dress, W.B. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

In the late 1970's, a technique for determining the mean density of a fluid surrounding a waveguide of non-circular cross section was developed using slow torsional ultrasonic pulses. With the waveguide only partially inserted in a liquid of known density, the length of the probe immersed in the liquid can be derived, and hence the level. The loss-of-cooling accident at TMI-2 in 1979 pointed out the need for a sensor to monitor continuously reactor vessel coolant level and density (i.e., void fractions). Devices utilizing torsional ultrasonic pulses can provide continuous readouts, in appropriate units, of level, density, and temperature along a chosen path in the reactor vessel, in a number of steps. Additional advantages of the torsional-wave level probe include ruggedness and long life provided by the simplicity of the waveguide structure - only a ribbon of stainless steel immersed in the reactor vessel. Thus the probe is expected to have a long life in the high neutron and gamma fluxes as well as being adaptable to current reactor designs.

18432 (NUREG/CP—0041-Vol.3, pp 193-210) **Development of a non-invasive liquid level and density gauge for nuclear power reactors (1981-82 progress report).** Jester, W.A.; Baratta, A.J. Jr.; Imel, G.; Foderaro, A.H.; Kenney, E.S.; McMaster, I.B.; Okyere, E.; Gundy, M.L. (Pennsylvania State Univ., University Park). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The accident at Three Mile Island Unit-2 (TMI-2) demonstrated the need for pressure vessel water level instrumentation. In

response to this need, a number of techniques have been proposed for level and/or density measurements. In this paper, a non-invasive system is described which can be used with the reactor at power or shutdown. In addition, to level information, the proposed system has been shown to be capable of density measurement.

18433 (NUREG/CP—0041-Vol.3, pp 226-234) **Guidance for air sampling at light water reactors.** Rich, B.; Ritter, P. (EG and G Idaho, Inc., Idaho Falls). Jan 1983. NTIS, PC A22/MF A01 - GPO $8.50. (CONF-821037—Vol.3). Contract AC07-76ID01570.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This report covers evaluations of radiological air sampling for all Nuclear Regulatory Commission licensees (including nuclear power plants). The evaluations were made under a technical assistance contract. Information gathered from a literature review, worksite visits, and equipment tests will provide an insight into the present status of air sampling and the possibility of improving the programs with new technology and improved methods. The product of this work will be a summary of findings, equipment and technique evaluations, and conclusions and recommendations for improving air sampling at nuclear facilities.

18434 (NUREG/CP—0041-Vol.4, pp 1-8) **Environmentally assisted cracking in light water reactors.** Shack, W.J. (Argonne National Lab., IL). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objectives of this program are to develop an independent capability for the detection and control of stress-corrosion cracking (SCC) in light-water reactor (LWR) systems and to evaluate of the technical merits of proposed remedies for the problem. The experimental work is initially concentrated on problems related to intergranular SCC in BWR piping systems. The BWR utilities, the reactor vendors, and related research organizations have developed remedies for the pipe cracking problems and have begun to develop the crack-growth-rate data base which is needed to assure the integrity of degraded piping and to develop an adequate plan for the inspection and monitoring of such piping. The performance of the remedies in laboratory tests is quite encouraging, but there are still technical questions which must be addressed to ensure that the laboratory results will accurately reflect performance in-reactor. For existing plants even with the assurance of leak-before-break it is important to upgrade the capability to detect leaks rather than completely relying on periodic in-service inspection. Although other leak detection system (e.g., moisture-sensitive tapes) will be considered, acoustic leak detection systems seem to offer the best combination of sensitivity, ability to locate a leak, and leak-rate measurement. The assessment and development of a practical leak detection system is another important objective of this program.

18435 (NUREG/CP—0041-Vol.4, pp 61-93) **Development of a plan for the assessment of degraded nuclear piping by experimentation and tearing instability fracture mechanics analysis.** Kanninen, M.F.; Wilkowski, G.M.; Pan, J.; Ahmad, J.; Marschall, C.W.; Gilbert, E.R.; Popelar, C.H.; Broek, D. (Battelle's Columbus Labs., OH). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Because nuclear plant pipe materials are very ductile and tough, even pipes with large cracks may have a considerable margin of safety against fracture. Ordinary linear elastic fracture mechanics is generally inadequate for these applications. This fact has led to the development of a nonlinear fracture mechanics approach known as a tearing instability analysis. But, while this approach is highly promising, it has yet to be validated for conditions that might occur in actual service. A two-phase effort was initiated to address this need. The primary objective of this research is to critically examine the tearing instability fracture mechanics analyses for the flaw sizes and loads - in both design and accident conditions - that would be expected to occur in actual nuclear plant operation. The work that has so far been accomplished constitutes Phase I of the program. The approach that has been followed involves work in three main areas: identification and acquisition of in-service degraded piping (for possible use in Phase II), and accumulating relevant pipe fracture experimental results; development and application of tearing instability analysis procedures for the assessment of existing pipe fracture data; and design and costing of a comprehensive experimental pipe fracture research program to be performed as Phase II.

18436 (NUREG/CP—0041-Vol.4, pp 157-167) **Irradiation and annealing sensitivity studies.** Hawthorne, J.R. (Materials Engineering Associates, Inc., Lanham, MD). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This report describes an evaluation of foreign steel production made to US guidelines for improved radiation resistance (new vessel forms) and investigations on radiation sensitivity and post-irradiation annealing for embrittlement relief (vessels produced 1971 or earlier). In the study of foreign steels, investigations coordinated by the IAEA and involving steels produced by West Germany, France, and Japan have confirmed the adequacy of the US-developed specifications. Progress of the Irradiation-Anneal-Reirradiation investigations are described, noting the synergism between copper impurities and nickel alloying in radiation sensitivity and annealing response. The PVI Surveillance Dosimetry Improvement Program, which as primary application to the more radiation sensitive vessels, is also discussed.

18437 (NUREG/CP—0041-Vol.4, pp 184-227) **Verification of effects of fuel management schemes on the condition of pressure vessels and their support structures.** McElroy, W.N. (Hanford Engineering Development Lab., Richland, WA); Gold, R.; Kellogg, L.S.; Lippincott, E.P.; Matsumoto, W.Y.; Ruddy, F.H.; Simons, R.L.; Ulseth, J.A.; Grundl, J.A.; McGarry, E.D. Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A number of potential methods exist for assuring the adequacy of fracture control of reactor pressure vessel (PV) beltlines under normal and accident loads. One of these methods, involving the use of fuel management schemes for reducing the rate of neutron damage accumulation at points of high neutron exposure, shows considerable promise. Practices for assessing and controlling the condition of PV beltlines and their support structures follow the recommendations in the US Code of Federal Regulations 10CFR50 (App. G and H) and 10CFR21, respectively, as well as those of the ASME Boiler and Pressure Vessel Code, Sec. III ad XI. In summary fashion, this paper reviews the methods for fracture behavior assessment and control and the interfaces with physics-dosimetry-metallurgy. It then reviews the calculated effects of new fuel management schemes on derived exposure parameter values for a representative PWR power plant. This is followed by a review of recent results of LWR Pressure Vessel Surveillance Dosimetry Improvement Program (LWR-PV-SDIP) interlaboratory efforts. Also provided is an updated set of references to the literature that is most relevant to the LWR-PV-SDIP work through September, 1982.

18438 (NUREG/CP—0041-Vol.4, pp 228-231) **Description and status of the NESTOR Dosimetry Improvement Programme (NESDIP).** Austin, M. (Rolls-Royce and Associates Ltd., Derby, England). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The NESTOR Dosimetry Improvement Programme (NESDIP) comprises a series of experiments in which, in conditions broadly representative of current light water reactor designs, some outstanding problems of pressure vessel (PV) dosimetry and monitoring can be explored. The objectives of the programme are as follows: (1) to provide benchmark quality measurements of neutron and gamma-ray fields against which calculational methods for predicting damage to PV and reactor internals can be validated. In addition provision will be made for the further development or re-

finement of necessary dosimetry measurement techniques; (2) to ensure that the programme complements, and where necessary extends, the scope of other international programmes in the PV dosimetry area - for example the USNRC/SDIP and the VENUS programmes; (3) to incorporate, as part of this complementary role, the requirements of external calculational and experimental groups in the development of the NESDIP. (This requirement has to conform to the overall level of time and resources available to the programme); and (4) to provide reports to calculational and experimental data derived as part of the programme in an available form, in a manner similar to those provided as part of the USNRC/SDIP.

18439 (NUREG/CP—0041-Vol.5, pp 63-87) **Nonlinear dynamic simulation and comparison with data.** Blakely, K. (ANCO Engineers, Inc., Culver City, CA). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A previously-existing linear-elastic finite element model was revised to match experimental data from the 1979 HDR URL piping system snapback tests. Model refinement primarily consisted of modeling the measured force-deflection characteristics of the swaybrace supports. The snapback tests (two different force levels) were simulated, and analytical results for nodal accelerations and support forces were compared to those obtained experimentally.

18440 (NUREG/CR—3275) **Job analysis of the electrician position for the nuclear power plant maintenance personnel reliability model.** Federman, P.J.; Bartter, W.D.; Siegel, A.I. (Applied Psychological Services, Inc., Wayne, PA (USA)). Feb 1984. Contract W-7405-ENG-26. 180p. (ORNL/TM—8755). NTIS, PC A09/MF A01 - GPO; GPO Dep. Order Number DE84006856.

This report presents the methods, procedures, and results of the fourth and final of a series of job analytic studies which characterize maintenance positions in nuclear power plants. The electrician position is the subject of the present report. The characterization of the electrician position takes the form of detailed information about: (1) the frequency of performing various tasks, (2) the time required for performing each task, (3) the training required for adequate performance of each task, and (4) the perceived consequences resulting from inadequate task performance. Additionally, information is presented about the intellective and the perceptual-motor loading imposed by each task. This information contributes to job design and training requirements derivation as well as to the assessment of human performance reliability in nuclear power plants.

18441 (NUREG/CR—3503) **Steam generator decontamination: methods and past applications.** Card, C.J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 75p. (PNL—4209). NTIS, PC A04/MF A01; 1 - GPO $4.50; GPO Dep. Order Number DE84005648.

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This report reviews information pertaining to decontamination methods currently available for use on steam generators. Three types of steam generator decontamination are considerd here: decontamination of the steam generator plus the primary system, decontamination of the isolated steam generator, and decontamination of components of the steam generator. Chemical, mechanical or electrochemical decontamination methods appropriate for each type of steam generator decontamination are described along with available information concerning waste volumes generated, corrosion rates, decontamination factors and other parameters affecting the success of each decontamination effort. Experience from past decontaminations is also documented. In addition, problems encountered and the degree of success achieved during past steam generator decontamination efforts are also presented.

18442 (UCID—20027) **Technical evaluation report on the monitoring of electric power to the reactor protection system for the Browns Ferry Nuclear Plant, Unit 1 (Docket No. 50-259).** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 16 Mar 1984. Contract W-7405-ENG-48. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008057.

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the Browns Ferry Nuclear Plant, Unit 1. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission.

18443 (UCID—20037) **Technical evaluation report on the monitoring of electric power to the reactor protection system for the Nine Mile Point Nuclear Station, Unit 1 (Docket No. 50-220).** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 16 Mar 1984. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009052.

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the Nine Mile Point Nuclear Station, Unit 1. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission. The proposed design modifications will protect the RPS from sustained abnormal voltage and frequency conditions from the supplying sources.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 18145, 18194, 18200, 18204, 18207, 18220, 18222, 18428, 18430, 18431, 18432, 18433, 18435, 18436, 18437, 18438, 18440, 18479, 18481, 18508, 18510, 18513, 18520, 18524, 18525, 18526, 18527, 18529, 18532, 18533, 18534, 18535, 18536, 18538, 18539, 18540, 18541, 18543, 18544, 18545, 18546, 18547, 18548, 18549, 18551, 18552, 18553, 18554, 18555, 18556, 18559, 18560, 18561, 18562, 18563, 18573, 18574, 18575, 18577, 18578, 18579, 18580, 18581, 18584, 18586, 18587, 18588, 18589, 18590, 18591, 18592, 18593, 18596, 18597, 18598, 18599, 18600, 18601, 18602, 18605, 18608, 18609, 18612, 18613, 18614, 18615, 18616, 18617, 18618, 18620, 18621, 18622, 18625, 18628

18444 (KAERI/RR—377/82, pp 1-237) **Water chemistry of PWR power plant.** Yang, K.R.; Yang, J.C.; Lee, I.C.; Kang, H.D.; Cho, S.W.; Whang, C.K. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A17/MF A01.

In Prevention of nuclear fuel cladding materials corrosion.

The only way which could be performed by the operator of nuclear power plant to minimize the degradation of nuclear fuel cladding material is to control the water quality of the primary coolant as specified standard conditions which does not attack the cladding material. If the water quality of reactor coolant does not meet far from the specification, the failure will occure not only cladding material itself but construction material of the primary system which contact with the coolant. The corrosion product of system material circulate through the whole primary system with the coolant and are activated by the neutron near the reactor core. The activated corrosion products and fission products which are released from fuel rod to the coolant, so called crud, will repeat deposition and redeposition continuously on the fuel rod and construction material surface. As a result we should consider the heat transfer problem. In this study the following activities were performed; 1. The crud sample was taken from the spent fuel rod surface of Kori unit one and analyzed for radioactive element and non radioactive chemical species. 2. The failure mode of nuclear fuel cladding material was estimated by the investigation of releasing type of fission products from the fuel rod to the reactor coolant using the iodine isotopes concentration of reactor coolants. 3. A study was carried out on the sipping test results of spent fuel and a discussion was made on the water quality control records through the past three cycle operation period of the Kori unit one plant.

18445 **(KFK—3594) Investigations on the retention of ^{131}I by an iodine filter of a pressurized water reactor.** Deuber, H.; Gerlach, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 2). Sep 1983. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750882.

The retention of ^{131}I by an equipment room exhaust filter of a German pressurized water reactor was determined by various methods to particularly obtain reliable results. Moreover, investigations were performed to clarify the reason for aging of the carbon contained in the iodine filter mentioned. The actual retention of the organic ^{131}I, corresponding to a value of 99.9%, was limited by ^{131}I in the form of penetrating iodine compounds. It was lower than the retention of CH_3 ^{131}I under layout conditions by more than one order of magnitude. The aging was essentially caused by the adsorption of low-volatile organic compounds.

18446 (NUREG/CP—0041-Vol.3, pp 166-172) **Demonstration of a noise surveillance system at a PWR.** Smith, C.M. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3). Contract W-7405-ENG-26.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

As a first step in demonstrating the practicality of performing continuous on-line surveillance of nuclear plants using noise related techniques, Oak Ridge National Laboratory is operating a computerized noise signal processing and data acquisition system at the Sequoyah Unit 1 Nuclear Plant, an 1148-MWe Westinghouse pressurized water reactor (PWR). The principal objective is to establish the long term signal characteristics of neutron and process signal sensors in order to evaluate the feasibility of detecting and diagnosing anomalous reactor conditions using these signals. The system is designed to screen the gathered data and identify for the noise analyst the data which differs statistically from norms which the system previously established. Currently the system aids the noise analyst although it is intended to eventually aid the plant operator. The system has access to 22 plant signals (seven ex-core neutron flux signals and several reactor coolant system flow, pressure, temperature, liquid level, and vibrational signals). The system has monitored these signals during the first fuel cycle and the collected data base is being studied to determine the noise signal character over this fuel cycle.

18447 (NUREG/CP—0041-Vol.4, pp 242-261) **Failure probability of a PWR pressure vessel subjected to pressurized thermal shock.** Strosnider, J. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objective of this study is to assess the contribution to reactor pressure vessel failure probability of recently observed thermal hydraulic transients using the most recent material property data. In this study, Monte Carlo simulation techniques have been used because of the ability to consider a greater number of significant random variables and to perform a wide spectrum of sensitivity studies. The results of extensive sensitivity studies conducted are extremely important because they quantify the effect of uncertainties in the input parameters, thereby providing an estimate of the accuracy of the calculated failure probabilities, and they identify the significant variables and variable interactions. The results are best applied in a relative sense, and extreme caution must be exercised in applying the results in an absolute sense.

18448 **(NUREG/CR—3491) OCA-II, a code for calculating the behavior of 2-D and 3-D surface flaws in a pressure vessel subjected to temperature and pressure transients.** Ball, D.G.; Drake, J.B.; Cheverton, R.D.; Iskander, S.K. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 101p. (ORNL—5934). NTIS, PC A06/MF A01 - GPO; GPO Dep. Order Number DE84007242.

The OCA-II computer code, like its predecessor OCA-I, performs the thermal, stress, and linear elastic fracture-mechanics analysis for long flaws on the surface of a cylinder that is subjected to thermal and pressure transients. OCA-II represents a revised and expanded version of OCA-I and includes as new features (1) cladding as a discrete region, (2) a finite-element subroutine for calculating the stresses, and (3) the ability to calculate stress intensity factors for certain three-dimensional flaws, for two-dimensional circumferential flaws on the inner surface, and for both axial and circumferential flaws on the outer surface. OCA-I considered only inner-surface flaws. An option is included in OCA-II that permits a search for critical values of fluence or nil-ductility reference temperature corresponding to a specified failure criterion. These and other features of OCA-II are described in the report, which also includes user instructions for the code.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 18116, 18516, 18517

18449 **(DOE/ET/34034—93) Advanced Gas Cooled Reactor Materials Program. Local gas chemistry measurement with gas sampling probes.** Baldwin, D.H. (General Electric Co., Schenectady, NY (USA). Turbine Technology Lab.). Jan 1984. Contract AC03-80ET34034. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007958.

GE has developed test stand modifications in the High Temperature Reactor Materials Testing Lab (HTRMTL) which permit extraction and analysis of gas samples from various points along the gas flow path within the test retort. These gas sampling probes were used to measure the depletion of CH_4, CO_2, and H_2O from simulated HTGR primary loop coolant as it passed through a test retort operated at 15 slpm of coolant flow and 950°C. The results of such measurements can be used to construct depletion profiles which enable the investigator to estimate the local gas chemistry at any desired point in such a system. Knowledge of local helium gas chemistry is imperative to interpreting test data obtained under conditions with depletion.

18450 **(GA-A—17369) HTGR Fuel Technology Program. Contract summary report for the period ending October 31, 1983.** (GA Technologies, Inc., San Diego, CA (USA)). Nov 1983. Contract AT03-76ET35300. 441p. NTIS, PC A19/MF A01; GPO Dep. Order Number DE84009382.

This document reports the technical accomplishments of the High Temperature Gas-Cooled Reactor (HTGR) Fuel Technology Program at GA Technologies Inc. during the second half of FY-83. The document also summarizes all reports issued during the full term of this contract, from January 1, 1963 through October 31, 1983. The activities in 1983 include work on the fuel process, fuel materials, fuel cycle, fission product transport, core component verification, and core technology transfer tasks necessary to support the design and development of a steam cycle-cogeneration (SC/C) version of the HTGR.

18451 **(GA-A—17381) HTGR plant technology program.** (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET35301. 281p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84007503.

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This report documents the technical accomplishments under Department of Energy Contract AT03-76ET35301, last known as the HTGR Plant Technology Program, at GA Technologies Inc. Detailed summaries describe the accomplishments during the final reporting period (April 1 through October 31, 1983). Work during the contractual period shifted emphasis from the direct cycle, gas turbine HTGR to a steam-cycle electric HTGR, and finally to a steam cycle/cogeneration HTGR. The most recent direction has been to support a steam cycle cogeneration plant with lesser but continuing efforts on higher-temperature applications and small, modular reactors.

18452 (NE-E—13-7T-Rev.) Nuclear Standard Fast Breeder Reactor uranium dioxide pellet. (Hanford Engineering Development Lab., Richland, WA (USA)). 12 Jan 1984. Contract AC06-76FF02170. 14p. Nuclear Standards Management Center, PO Box Y, Oak Ridge, TN 37831.

18453 (NP—4900837) Environmental Radiation Surveillance Program: Fort St. Vrain Nuclear Generating Station. Summary report, third and fourth quarters, 1983. Johnson, J.E. (Colorado State Univ., Fort Collins (USA)). 1983. 143p. Colorado State Univ., 2420 W. 26th Ave., Suite 100D, Denver, CO 80211.

The total energy generated was 4.9 times that generated during the first half of 1983, the previous reporting period. The radioactivity released in reactor effluents, however, did not increase by that proportion. The effluent release of tritium, the major radionuclide released that is measured in this project, actually was less during the last half of 1983 than during the first half of 1983. This is due to several reasons, but principally a result of the plant shutdown during April, May, and June of 1983. A complete and detailed listing of radioactivity released by all effluent routes may be found in the Public Service Company of Colorado's Semi-annual Effluent Release Report to the US Nuclear Regulatory Commission. When possible in this report any correlation of radioactivity in environmental samples with the effluent release data is discussed.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 18428, 18509, 18597

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 18115, 18119, 18123, 18126, 18131, 18512, 18614, 18618, 18619

18454 (CONF-830702—20) Three-dimensional finite-element analysis of the cellular convection phenomena in the Clinch River Breeder Reactor Plant prototype pump. Silver, A.H.; Lee, J.Y. (Borg-Warner Corp., Carson, CA (USA). Byron Jackson Pump Div.). 1983. Contract AT03-76SF72025. 6p. NTIS MF A01; 2; GPO Dep. Order Number DE83015538.

From 21. ASME/AIChE national heat transfer conference; Seattle, WA, USA (24 Jul 1983).

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Cellular convection was studied rigorously during the development of the Clinch River Breeder Reactor Plant (CRBRP) Program Pumps. This paper presents the development of a three-dimensional finite-element heat transfer model which accounts for the cellular convection phenomena. A buoyancy driven cellular convection flow pattern is introduced in the annulus region between the upper inner structure and the pump tank. Steady-state thermal data were obtained for several test conditions for argon gas pressures up to 93 psig (741 kPa) and sodium operating temperatures to 1000°F (811°K). Test temperature distributions on the pump tank and inner structure were correlated with numerical results and excellent agreement was obtained.

18455 (HEDL-SA—2842-FP) Structural considerations for hot and cold pipe clamps in LMFBR applications. Anderson, M.J.; Huang, S.N.; Wagner, S.E.; Kappauf, H.; Wirtz, K.H. (Hanford Engineering Development Lab., Richland, WA (USA)). 1983. Contract AC06-76FF02170. 23p. (CONF-830607—32). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006564.

From American Society of Mechanical Engineers pressure vessel and piping conference; Portland, OR, USA (19 Jun 1983).

A series of analytical studies are described which evaluate stress levels induced in a 600 mm high temperature, thin-wall sodium pipeline by two alternate clamp designs. The first design consists of a band mounted directly on the pipe and is called the hot clamp. The second design consists of a band mounted using insulation standoffs and is called the cold clamp. Pipe stress levels induced by transient thermal dead weight and seismic loads are discussed. Pipe stress levels and system dynamic spring rates are presented. Procedures utilized to combine clamp induced pipe stress with other short and long term pipe system stresses are detailed. Recommendations for practical application in LMFBR pipe systems are made.

18456 (HEDL-SA—2931) Automated breeder fuel fabrication. Goldmann, L.H.; Frederickson, J.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 1 Sep 1983. Contract AC06-76FF02170. 12p. (CONF-8310175—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006892.

From 36. annual Pacific Coast Regional meeting of the American Ceramic Society; San Diego, CA, USA (3 Oct 1983).

The objective of the Secure Automated Fabrication (SAF) Project is to develop remotely operated equipment for the processing and manufacturing of breeder reactor fuel pins. The SAF line will be installed in the Fuels and Materials Examination Facility (FMEF). The FMEF is presently under construction at the Department of Energy's (DOE) Hanford site near Richland, Washington, and is operated by the Westinghouse Hanford Company (WHC). The fabrication and support systems of the SAF line are designed for computer-controlled operation from a centralized control room. Remote and automated fuel fabriction operations will result in: reduced radiation exposure to workers; enhanced safeguards; improved product quality; near real-time accountability, and increased productivity. The present schedule calls for installation of SAF line equipment in the FMEF beginning in 1984, with qualifying runs starting in 1986 and production commencing in 1987. 5 figures.

18457 (NE-E—13-6T-Rev.) Fast breeder reactor mixed oxide fuel pellet, January 1984. (Hanford Engineering Development Lab., Richland, WA (USA)). 12 Jan 1984. Contract AC06-76FF02170. 23p. Nuclear Standards Management Center, Oak Ridge, TN 37831.

18458 (NE-M—14-2T-Rev.) Nuclear standard fuel and control assembly tag gas. (Hanford Engineering Development Lab., Richland, WA (USA)). 12 Jan 1984. Contract AC06-76FF02170. 19p. Nuclear Standards Management Center, Oak Ridge, TN 37831.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

18459 (CNLM—5326-Suppl.1) Activation of electrical machinery. Supplement 1. Smolen, J.R. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 15 Nov 1963. Contract AC02-84PW02789. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007051.

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The following analysis of the induced radioactivity in SNAP-50/SPUR electrical machinery having a high cobalt content is submitted. Induced radioactivity in the flight vehicle will contribute negligibly to allowable radiation levels. This is especially so due to the low neutron to gamma ratio of assumed radiation damage tolerances to semiconductors. A calculation to estimate the order of magnitude of induced radioactivity in cobalt is attached. The calculation is based on a best guess of the neutron spectrum directly behind a lithium hydride shield. The resulting low cobalt activity and associated dose rate of about 1 mr/hr at 10 ft from a generator or a motor is insignificant. Although the evaluation indicates insignificant levels of induced radioactivity, this conclusion is not applicable to a ground test. Neutron moderation and scattering from a containment vessel and biological shield would greatly perturb the neutron environment behind the flight shield. Posttest handling of all components within the vacuum test chamber will undoubtedly be a problem. Notwithstanding the importance of limiting induced radioactivity, other considerations such as economy, cooling and vacuum requirements will largely dictate the final facility design. In summary, an activation analysis involves the overall facility design and will not be readily resolved. For a 10,000 hr. test the Co^{60} activity may range from 100 curies per lb of cobalt where no shield-

ing is provided to 10^{-3} curies per lb of cobalt where the equivalent of a flight shield is provided.

18460 (CNLM—5760-Rev.1) Rough draft of proposed classification guide for the design, development, manufacture and testing of the high temperature reactor and powerplant for the SNAP-50/SPUR program. Revision 1. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 12 Oct 1964. Contract AC02-84PW02789. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007126.

The topics of this guide may be used in making day-to-day classification determinations. Requests for additional classification guidance, clarification of specific topics of declassification of information on a specific reactor in this program may be submitted through appropriate AEC organization channels to the Division of Classification, AEC Headquarters, for review. Nearly all of this material is now declassified, so the value of the guide may be mostly historical.

18461 (NASA-TM-X—2950) Examination of T-111 clad uranium nitride fuel pins irradiated up to 13,000 hours at a clad temperature of 990°C. Slaby, J.G.; Siegel, B.L.; Bowles, K.J.; Galbo, R.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 10 Sep 1973. 46p. NTIS, PC A03. Order Number DE84900884.

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The examination of 27 fuel pins irradiated in the Plum Brook reactor facility is described. Curtailment of NASA sponsored nuclear programs prevented a complete examination of all pins. Nevertheless, results include fuel pin integrity, clad ductility, clad strain, fission gas release, fuel burnup, fuel swelling, neutron fluence, metallography, and instrumentation reliability. Twenty-two fuel pins were tested for fission gas leaks; 13 pins leaked with two having visible cracks. Fuel swelling appeared to be primarily burnup dependent for burnup values up to 2 at. %. Maximum burnup reached in these tests was 2.34 at. %. In general, the fuel pellets did not crack or crumble and fuel metallography remained unchanged. The amount of fission gas released from the fuel was low, generally less than 0.5%. The maximum amount released was 2%. No incompatibilities between fuel, liner, and clad were evident.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 18429, 18489, 18523

18462 (NUREG—0304-Vol.8-No.4) Regulatory and technical reports. Compilation for 1983. Vol. 8, No. 4. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Feb 1984. 562p. NTIS, PC A24/MF A01 - GPO. Order Number DE84900835.

The main citations in this compilation are listed in NUREG citation number order. These indexes are included: contractor report number index, personal author index, subject index, NRC originating organization index (staff reports), NRC contractor sponsor index (contractor reports), contractor index, and licensed facility index. The compilation is for 1983. (GHT)

18463 (NUREG—0748-Vol.4-No.1) Operating reactors licensing actions summary. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Mar 1984. 329p. NTIS, PC A15/MF A01 - GPO. Order Number DE84900894.

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The operating reactors licensing actions summary is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors.

18464 (NUREG—0750-Vol.18-No.4) Nuclear Regulatory Commission issuances, October 1983. Vol. 18, No. 4. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Oct 1983. 401p. NTIS, PC A18/MF A01 - GPO. Order Number DE84900915.

This report includes the issuances received during October 1983 from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

18465 (NUREG/CR—3508) Standard setting standards: a systematic approach to managing public health and safety risks. Fischhoff, B. (Decision Research, Eugene, OR (USA)). Feb 1984. Contract W-7405-ENG-26. 65p. (ORNL/Sub—7576/3). NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. Order Number DE84006853.

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This guide presents a general framework for the design, development, and implementation of safety standards. That framework is derived from the logical character of the standard setters' task and from experience with actual standards. It first identifies the conditions under which standards are an appropriate management tool. Second, it presents four generic methods that may be used to develop safety policy. Third, it characterizes the design issues that arise in making that policy operational. At each step, it suggests particular strategies along with their inherent strengths and weaknesses. In particular, it shows the sensitivity of a standard's effective policy to seemingly technical aspects of the way it is drafted.

18466 (NUREG/CR—3645) Guide to literature relevant to the organization and administration of nuclear power plants. Sommers, P. (Battelle Human Affairs Research Centers, Washington, DC (USA); Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 657p. (PNL—4906; BHARC—300/83/033). NTIS, PC A99/MF A01 - GPO $11.00; GPO Dep. Order Number DE84008046.

The purpose of this report is to assist applicants for a nuclear power plant operating license through a structured review of the organization and administration literature. The Nuclear Regulatory Commission reviews an applicant's proposed organization and administration as part of the operating license review. NRC is developing draft Guidelines for a Utility Organization Plan and a proposed Workbook for Assessment of Organization and Administration for reviewing responses to the guidelines. It is the intention of the NRC to incorporate these documents when completed into Chapter 13 of the Standard Review Plan NUREG-0800. This report assists users of the Guidelines and Workbook by providing a guide to the academic and government literatures relevant to the concepts used in these two regulatory documents. Persons preparing responses to the Guidelines or reviewing these responses can locate literature relevant to a particular topic discussed in the Guidelines or Workbook through use of this report.

2108 Economics

REFER ALSO TO CITATION(S) 18113, 18127, 18128, 18129, 18130, 18132, 18148, 18267

18467 (TVA/OP/EDT—84/16) Analysis of nuclear power plant component failures. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). Jan 1984. 116p. NTIS, PC A06/MF A01. Order Number DE84900906.

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Items are shown that have caused 90% of the nuclear unit outages and/or deratings between 1971 and 1980 and the magnitude of the problem indicated by an estimate of power replacement cost when the units are out of service or derated. The funding EPRI has provided on these specific items for R and D and technology transfer in the past and the funding planned in the future (1982 to 1986) are shown. EPRI's R and D may help the utilities on only a small part of their nuclear unit outage problems. For example, refueling is the major cause for nuclear unit outages or deratings and the steam turbine is the second major cause for nuclear unit outages; however, these two items have been ranked fairly low on the EPRI priority list for R and D funding. Other items such as nuclear safety (NRC requirements), reactor general, reactor and safety valves and

piping, and reactor fuel appear to be receiving more priority than is necessary as determined by analysis of nuclear unit outage causes.

2109 Process Heat Reactors

REFER ALSO TO CITATION(S) 18516

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 18485, 18515, 18899

18468 (JAERI-M—9999, pp 317-355) **Making and evaluated photon production nuclear data file and its application to photonic calculation.** Kawai, Masayoshi (Nippon Atomic Industry Group Co. Ltd., Tokyo). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8111184—; NEANDC(J)—81/U; INDC(JAP)—68/L).

From Seminar on nuclear data; Tokai, Ibaraki, Japan (26 Nov 1981).

There is a plan to make JENDL-3 containing a photon production nuclear data file. This report describes the input format and some checking items for making a evaluated photon production data file, showing the typical examples of ENDF/B-IV data. Moreover, its application to photonic calculation in the nuclear reactor analysis is described. In general, photon production cross sections are processed together with neutron and photon cross sections into the reactor group constants for transport calculation. As an example, the author presents the analyses of measured gamma-ray dose rate in the fast critical assembly, the shielding analyses for Japanese fast experimental breeder reactor "JOYO", and so on. The photon production nuclear data important to reactor shielding calculation are also assessed by means of cross section sensitivity analysis.

18469 (KFK—3554) **NAUA Mod 4.** Bunz, H.; Koyro, M.; Schoeck, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Aug 1983. 69p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750871.

This report describes the computer program NAUA Mod4. Its purpose is to calculate the behaviour of a polydisperse aerosol system in a closed vessel containing a condensing atmosphere as a function of the time. The main object is to explain the physical background and to describe the structure of the code and the input and output in detail.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 18583, 18585, 18754, 18805

18470 (INIS-mf—8362) **Fracture behaviour and nondestructive testing in the series safety of the pressure boundary of light water reactors. Materials for advanced reactor systems.** (Stuttgart Univ. (Germany, F.R.). Staatliche Materialpruefungsanstalt). 1982. 498p. (In German). (CONF-8210219—). NTIS (US Sales Only), PC A21/MF A01. Order Number DE84780071.

From 8. MPA seminar; Stuttgart, F.R. Germany (14 Oct 1982).

The present booklet contains the full text of 21 papers presented at the 8th MPA-Seminar in Stuttgart Oct. 1982. The papers deal with fracture mechanics and nondestructive testing in connection with the safety of the pressure boundary of light water reactors and with materials for advanced reactor systems.

18471 (JAERI-M—9775, pp 79-88) **Refrectory materials (e.g. V, Nb, Ta, Mo, W and alloys) for the first wall.** Nakagawa, Masuo (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Nov 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-810189—).

From Workshop on the particle material interaction for fusion research; Tokyo, Japan (12 Jan 1981).

The refractory materials for the first wall have been studied. The induced activity and its decay of the materials were estimated. The decay of the activity of V was fast, and that of stainless steel was slow. The nuclear transformation and gas production in the materials were investigated. The gas (H and He) production in V was large. The nuclear transformation effects in fusion reactors are 10 to 100 times as large as those in fast reactors. The chemical properties and the compatibility of coolant and structures were studied. The compatibility of Mo and W was better than stainless steel. The mechanical properties of refractory materials were also better than SUS. The data on the variation of mechanical properties under fast neutron irradiation are important, but are hardly available. The materials, Mo, Nb, Ta and W, have excellent surface properties regarding vapour pressure. Number or particle reflection coefficient, energy reflection coefficient, the trapping efficiency of H ions and D ions, reflection and surface deformation characteristics, sputtering yield and radiation damage have been examined for the refractory materials.

18472 (NUREG/CP—0041-Vol.3, pp 55-59) **Human factors in loose parts monitoring.** Howard, J.H. Jr. Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The present study was undertaken to assess the safety-related information potentially available to power reactor operators in the audio output. To accomplish this several tasks were completed. First, a literature review was carried out to identify acoustic signal parameters of primary interest and to relate these physical parameters to known human auditory detection and recognition capabilities. An objective of this task was to determine the level of performance to be expected during manual operation of current and future loose parts monitors. Second, the current use of auditory information in loose parts monitoring was determined. Recommendations are made.

18473 (NUREG/CP—0041-Vol.4, pp 47-60) **Improved eddy-current testing for longitudinal and circumferential flaws in steam generator tubing.** Dodd, C.V. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4). Contract W-7405-ENG-26.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The ORNL-developed multiple-frequency instrumentation is essentially complete and has been successfully tested in several different field applications. Improvements are being made in the software and the basic instrument is being applied to different test applications. Due to recent steam generator failures, a major emphasis has been given to the design and development of pancake coil probes. Both analytical and dimensional analysis techniques have been applied. A pancake coil probe has been developed and tested that improves the signal-to-noise ratio to small defects by a factor of ten over the standard circumferential coil. In addition, the pancake coil probe can detect both axial and circumferential flaws, while the circumferential probe can only detect axial flaws. This type of probe will give a more sensitive inspection but will be more expensive to manufacture.

18474 (ORNL/TM—9066) **In-plant reliability data base for nuclear plant components: a feasibility study on human error information.** Borkowski, R.J.; Fragola, J.R.; Schurman, D.L.; Johnson, J.W. (Oak Ridge National Lab., TN (USA); Science Applications, Inc., New York (USA); Applied Science Associates, Inc., Valencia, PA (USA); Nuclear Regulatory Commission, Rockville, MD (USA)). Mar 1984. Contract W-7405-ENG-26. 51p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009381.

This report documents the procedure and final results of a feasibility study which examined the usefulness of nuclear plant maintenance work requests in the IPRDS as tools for understanding human error and its influence on component failure and repair. Developed in this study were (1) a set of criteria for judging the quality of a plant maintenance record set for studying human error;

(2) a scheme for identifying human errors in the maintenance records; and (3) two taxonomies (engineering-based and psychology-based) for categorizing and coding human error-related events.

18475 **Acceptance testing of graphite/epoxy composite parts using an acoustic emission monitoring technique.** Hamstad, M. (Lawrence Livermore National Lab., CA). *NDT (Non-Destructive Testing) International;* 307-314(Dec 1982). Contract W-7405-ENG-48.

A graphite/epoxy composite dome was proof-tested by pressurization. Acoustic emission (AE) data was obtained during the proof test. A low-frequency bandpass was used to minimize AE signal propagation losses. The AE system and test part were calibrated in situ by an instrumented pencil-lead break. Large energy AE signals provide a clear indication of a flawed composite part. 7 references, 13 figures, 3 tables.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 18143, 18558

18476 **(KAERI/RR—377/82) Prevention of nuclear fuel cladding materials corrosion.** (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 385p. NTIS (US Sales Only), PC A17/MF A01. Order Number DE84780088.

Separate abstracts are presented for each of the papers included in the data base.

18477 **(NUREG/CR—3171) Data summary report for fission product release test HI-2.** Osborne, M.F.; Lorenz, R.A.; Travis, J.R.; Webster, C.S.; Norwood, K.S. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 61p. (ORNL/TM—8667). NTIS, PC A04/MF A01 - GPO; GPO Dep. Order Number DE84006844.

The second in a series of high-temperature fission product release tests was conducted for 20 min at about 1700°C in flowing steam. The test specimen, a 20-cm-long section of an H.B. Robinson fuel rod that had been irradiated to a burnup of 28,000 MWd/t, was heated in an induction furnace mounted in a hot cell. Posttest analyses of the furnace, the thermal gradient tube, filters, and other components of the experimental apparatus showed that about 50% of the ^{85}Kr, ^{137}Cs, and ^{129}I were released from the specimen during the test. In addition, approximately 2% of the /sup 110 m/ Ag and ^{125}Sb along with smaller fractions of several other radionuclides were measured by gamma spectrometery. Spark-source mass spectrometric data from a limited number of samples showed significant releases of fission product tellurium and molybdenum, as well as structural (zirconium and tin) and furnace (primarily tungsten) materials. Metallographic examination of the fuel specimen revealed extensive fractures in the cladding, essentially complete oxidation to ZrO_2, and evidence of fuel-cladding interaction.

2204 Control Systems

REFER ALSO TO CITATION(S) 18565, 18574

18478 **(BMI—1983-010) Improvement and standardization of communication means for control room personnel.** Preuss, W.; Eggerdinger, C.; Sieber, R. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Sep 1983. 296p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84750750.

The subjects under investigation were the "Shift book", "Simulation book", and "Technical and organisational changes and their records". It was intended to analyse both the communication processes and the associated written documentation in order to determine areas for potential improvement and possibilities for standardization. Information was obtained by interviewing shift members and their supervisors, by general observation, and by compilation and evaluation of the extensive dokumentation. Assessment criteria were developed on a scientific basis and in the course of the investigation, in particular from ergonomic findings, as well as from standards and regulations and comparison between the plants. General practical suggestions were developed for the improvement of the communication forms and the formal design of the documents and their contents. The transfer of the recommendations to practical use in the plants presupposes the consideration of plant-specific frames of reference. The report includes a compilation and listing of suggestions for improvement in topical subdivisions.

18479 **(IKE—6-125) Investigation of the burn-up behavior of boron poison rods, placed in a fuel assembly of a pressurized water reactor.** Arnold, C.; Lutz, D.C. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Sep 1979. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750880.

The excess reactivity of a pressurized water reactor is compensated by boron, disolved in the moderator. In addition during the first cycle boron poison rods are placed in fuel assemblies without control rods. The burn-up behavior of a poison rod in a Biblis B fuel assembly is analysed in the present paper. Multigroup spectrum calculations were performed. The influence of critical boron concentration depending from burn-up, the changes of fuel concentration and the concentration of burnable poison were taken into consideration. Furthermore the built-up of rapidly saturating fisson products ^{135}Xe and ^{149}Sm was considered. The interaction of these effects are discussed. Spatial influences are emphasized most. Finally two group cross sections were calculated. The results are compared with calculations for a fuel assembly of the same type without burnable poison rods.

18480 **(Juel—1853) Model investigations on core monitoring in large pebble-bed HTGRs using fast fission chambers in the top reflector.** Carlson, D.E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jun 1983. 223p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE84750878.

The work presented here is concerned with the detection of flux irregularities in large pebble-bed high-temperature reactors by means of measuring the fast (Esub(n) > 0.1 MeV) neutron flux distribution in the lower region of the top reflector. In Part I, the feasibility of using fast fission chambers for measuring the fast flux is examined. For continuous measurements over a period of three years with ^{237}Np-, ^{238}U-, ^{231}Pa- or ^{236}U-lined fast fission chambers, calculations show that adequate suppression of the breeding effects is attained by shielding the detectors with 4 mm of 90 At.% ^{10}B-enriched B_4C. Concepts for removing the heat generated in the detector shields are analysed as well. In Part II, the propagation of eccentric flux disturbances from the upper core region into the top reflector is investiged with the aid of a detailed three-dimensional diffusion model of the PNP-3000 reactor. The computer model developed for this purpose is also used for evaluating the effects of the detector shields in the top reflector on the reactivity and control of the reactor. In Part III, a new flux mapping matrix procedure is introduced and tested. By processing the flux signals from all detectors in the top reflector, this matrix method facilitates the detection and reconstruction of spacial flux disturbances near the core surface. From the test results of the flux mapping procedure, the advantages of fast flux measurements as opposed to hypothetical thermal flux measurements for detecting a fuel misloading become most apparent.

18481 (KAERI/RR—377/82, pp 1-85) **Water chemistry of PWR power plant.** Yang, K.R.; Yang, J.C.; Lee, I.C.; Kang, H.D.; Cho, S.W.; Whang, C.K. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A17/MF A01.

In Improvement of the primary coolant radioactivity monitoring system.

In order to assure fuel performance and reactor water quality control, it is required periodically that samples are taken from the primary coolant of the nuclear power plant for analysis. These analyses require a large expenditure of time, manpower and relevant personnel radiation exposure due to manual operation. Accordingly, an automatic on-line monitoring system is being developed by KAERI. This project commenced at the beginning of this year. The system provides on-line real time data for continuous monitoring of the isotopic concentration of the primary loop cool-

ant via continuous side stream from the hot leg to the volume control tank. Isotopic information is obtained from a lithium drifted germanium gamma spectrometer. In addition, gross gamma information is provided by a NaI(TI) scintillation detector. The control for the sample changer, measuting instrument and analysis of measurement data is performed by data microprocessing. "To attendant" operation is possible for 24 hours, therefore, due to this automatically operating systems. The acceptance test will be performed at KNU No.1. to obtain data required to assess design requirements and to determine the functional capability of this monitoring system.

18482 (NUREG/CP—0041-Vol.3, pp 44-51) **Task analysis of nuclear power plant control room crews.** Burgy, D.C. (General Physics Corp., Columbia, MD). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A task analysis of nuclear power plant control room crews is being performed by General Physics for the Office of Nuclear Regulatory Research. The objective of the project is to conduct a crew task analysis which will provide data for evaluating six areas: human engineering design of control rooms and retrofitting of current control rooms; the numbers and types of control room operators required with requisite skills and knowledge; operator qualification and training requirements; normal, off-normal, and emergency operating procedures; job performance aids; and communications. The task analysis methodology employed in the project offers an effective approach to collecting information which describes power plant crew composition, their activities and their environment. The task data collected on the crews will provide a firm technical basis for the development of guidelines and regulations directed at improved operational safety.

18483 (NUREG/CR—3461) **Response tree evaluation - implications for the use of artificial intelligence in process control rooms.** Bray, M.A.; Nelson, W.R.; Blackman, H.S.; Fowler, R.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1984. Contract AC07-76ID01570. 32p. (EGG—2272). NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. Order Number DE84005826.

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An experiment was performed during 1983 that measured performance of nuclear plant operators with and without a computer-based operator aid. This report discusses the results of that experiment and their implications for design and regulation of advanced computer aids in nuclear control rooms. The aid tested is called a response tree and is intended to help operators properly align a piping system despite component or support system failures. In the experiment, 28 reactor operator subjects were required to align a system to inject coolant and stop a temperature excursion in a simulated reactor. The experiment did not show an improvement in operator performance when the response tree aid was used. More important, the experiment did produce several conclusions related to the design and evaluation of computer aids in nuclear control rooms.

18484 (SAND—83-2165) **Moisture permeation into nuclear reactor pressure transmitters.** Keenan, M.R. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. Contract AC04-76DP00789. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008357.

Analytical solutions are presented for the pressure buildup in single or concentric containers having known leak rates and exposed to a constant exterior pressure. The effects of constant gas sources and/or sinks within the container are also included in the general solutions. Using thse equations, and identifying the leak rates with the moisture permeation rates of their elastomeric seals, estimates are made of the moisture content as a function of time inside of pressure transmitters of the type used in nuclear power plants. The results indicate that 50% of the exterior humidity will be realized in six months and that the 90% level will be attained within a couple of years. The addition of a small amount (several grams) of desiccant, however, would control the humidity at acceptable low levels for the lifetime of the tranmitter.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 18200, 18203, 18204, 18207, 18453, 18627, 18628, 19224

18485 **(JAERI-M—82-109) Calculation on the diffusion and release behavior of fission products in the first and second OGL-1 fuel sleeves.** Hayashi, Kimio; Ikawa, Katsuichi. (Japan Atomic Energy Research Inst., Tokyo). Sep 1982. 30p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700097.

Based on the Fick's law the computer program FPDR has been developed to calculate the one-dimensional diffusion and release behavior of fission products in the graphite sleeves of the first and second OGL-1 fuel assembly. Through the comparison between the measured and calculated penetration profiles, the diffusion coefficient of ^{90}Sr in the first fuel sleeve has been estimated to be (2 -- 5) x 10^{-13} m^2/s; those of ^{137}Cs and ^{90}Sr in the second fuel sleeve around or larger than 1 x 10^{-13} m^2/s, and ~10^{-14} m^2/s, respectively. The release of ^{90}Sr from the second fuel sleeve is negligible; that of ^{137}Cs depends linearly on its diffusion coefficient if the coefficient is larger than 10^{-12} m^2/s, but practically does not depend on its evaporation parameter.

18486 **(KAERI/RR—361/82) Technology development on seismic analysis of nuclear reactor structure.** Kwak, E.H.; Kim, D.H.; Kim, Y.S.; Cho, U.Y.; Woo, C.S.; Chang, H.J. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 123p. (In Korean). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700099.

The prime object of this study is to develop the seismic analysis procedures and to evaluate the structures, systems or components in nuclear power plants in view of seismic safety by the soil-structure interaction (SSI) analysis for the dynamic characteristics of earth's surface to the earthquake motions. The artificial time histories for the design of NPP site were, then, generated. The methods and procedures for the soil-structure interaction analysis, and the technology for the Floor Response Spectra (FRS) generation were established. In connection with this procedures and technology, the computer codes "TIGEN" and "SUPRES" to generate the artificial time histories compatible with floor design response spectrum were developed and the use of "SAP V" and"FLUSH" codes were made in SSI analysis to assess the dynamic characteristics of the mathematical model for the building and structures. The modification for "SPECTR" code developed already was made so as to generate floor design response spectra that will be used for seismic qualification of the equipments/systems of NPP.

18487 **(KAERI/RR—380/82) Seismic risk map of Korea.** Lee, S.H.; Lee, Y.K.; Eum, S.H.; Yang, S.J.; Chun, M.S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 295p. (In Korean). NTIS (US Sales Only), PC A13/MF A01. Order Number DE84700101.

A study on seismic hazard level in Korea has been performed and the main results of the study are summarized as follows: 1. Historians suggest that the quality of historical earthquake data may be accurate in some degree and the data should be used in seismic risk analysis. 2. The historical damage events are confirmed in historical literatures and their intensities are re-evaluated by joint researchers. The maximum MM intensity of them is VIII evaluated for 17 events. 3. The relation of earthquakes to surface fault is not clear. It seems reasonable to relate them to tectonic provinces. 4. Statistical seismic risk analysis shows that the acceleration expected within a 500 year return period is less than 0.25G when only instrumental earthquakes are used and less than 0.10G if all of instrumental and historical earthquakes are used. The acceleration in Western Coast and Kyungsang area is higher than the other regions in Korea. 5. The maximum horizontal acceleration determined by conservative method is 0.26G when historical earthquake data are used and less than 0.20G if only instrumental earthquakes are used. The return period of 0.26G is 240 years in Kyungsang province and longer in other provinces.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 18114, 18115, 18438, 18743, 18977

18488 (DOE/NBM—4007547) ORNL presentation to the major materials facilities committee of the National Research Council. Bartine, D.E.; Cable, J.W.; Mook, H.A.; Moon, R.M.; Nicklow, R.M. (Oak Ridge National Lab., TN (USA)). 26 Feb 1984. Contract W-7405-ENG-26. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007547.

For an improved high-flux reactor for purposes of neutron scattering, isotope production, and materials irradiation, ORNL is beginning an effort to produce the world's best research reactor. We expect to achieve a peak thermal flux in a D_2O reflector of 5 x 10^{15} n/cm^2 s. Through improved beam tube design and focusing monochromators, the number of neutrons incident on the sample could be increased by an order of magnitude over the best now available. The reactor would be fully equipped with two cold sources, a hot source, and about 30 advanced instruments. The six cold guides would have a potential scientific value four times greater than the comparable facilities at the Institut Laue-Langevin. Our initial efforts have been focused on a major upgrade of the High Flux Isotope Reactor (HFIR).

18489 (GKSS—83/E/27) Aspects of the licensing procedures for enrichment reduction in research reactors. Krull, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Zentralabteilung Forschungsreaktoren). 1983. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750860.

The enrichment reduction for research reactors requires a licensing procedure. For this purpose the qualification of the new fuel has to be demonstrated and changes in reactor safety have to be investigated like reactivity values, form-factors, Pu- and fission product inventory, safety margins and accidents. Calculations should be partly experimentally verified. The possible extent of the licensing procedure is discussed.

18490 (GKSS—83/E/37) Optimization of a cold neutron source at the FRG-1. Turgut, M.H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 67p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750876.

This paper describes the optimization of a cold neutron source (CNS) for maximizing the subthermal flux in the energy range 2.27-5.12 MeV at the beam tube of FRG-1 reactor. In addition, the gain by using different reflectors (H_2O, C, D_2O) around the CNS is discussed. Advantage factors (resulting from the use of CNS) are calculated for various configurations by means of the transport code NEUTRA. The cross-sections for NEUTRA are prepared by the spectral code GGC-4.

18491 (HEDL-SA—3078-FP) Hands-on repair of component with a lowered pool water level. Perfect, J.F. (Hanford Engineering Development Lab., Richland, WA (USA)). 12 Mar 1984. Contract AC06-76FF02170. 12p. (CONF-840386—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007172.

From 9. US TRIGA owner-user conference; Anaheim, CA, USA (12 Mar 1984).

The repair of a broken positioner mechanism on a TRIGA Reactor neutron collimator, with a lowered pool water level, presented a unique challenge. Radiation dose measurements were made which indicated the repair could be done safetly with only 3 feet of water providing shielding over the reactor core. The entire repair project went quite well, due in large part to extensive preplanning. Repair was done safely and radiation exposures were kept well below allowable levels. Savings were significant using this method of repair compared to the alternative of dismantling the facility.

18492 (NUREG/CR—3666) Assessment of the implications of conversion of university research and training reactors to low enrichment uranium fuel. Harris, D.R.; Burn, R.R.; Clark, L.; Parkinson, T.F. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Feb 1984. 167p. NTIS, PC A08/MF A01 - GPO $5.50. Order Number DE84900873.

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The tasks associated with conversion of a research reactor from HEU to LEU fuel are: initial program planning; safety analysis and license amendment; core physics calculations; operating thermal-hydraulics analysis; plant engineering modifications; LEU fuel specifications, procurement of fuel, and calculational confirmation of design; training of staff personnel; HEU core physics measurements and fuel disposal; and experimental verification of reactor behavior with LEU fuel. LEU fuel conversion of the 25 NRC licensed, university-owned reactors considered in this study is based upon the reactor fuel cycle, the type of license modification, and fuel meat technology. Reactors that operate on routine refueling cycles could periodically replace depleted HEU elements with fresh LEU elements. Ultimate full core conversion would depend on the average element residence time in the core. Reactors with lifetime cores would convert by full core replacement as a one-time event. For some reactors, LEU conversion depends upon high density uranium fuel meat technology development. The majority should be able to convert using a direct substitution of current fuel meat technology though some fuel plate or rod internal modifications may be necessary for 16 of the reactors.

2207 Plutonium And Isotope Production Reactors

18493 (DP-MS—84-23) Operational readiness reviews for restart of L reactor. Finley, R.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 16p. (CONF-840257—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009075.

From DOE nuclear reactor and facility safety conference; Rockville, MD, USA (27 Feb 1984).

The L Reactor at the Savannah River Plant is being restarted after being in a standby status since 1968. Operational Readiness Reviews (ORRs) were conducted by DOE-SR and contractor personnel concurrent with the restart activity. This paper summarizes the ORR activity.

18494 (DPST—59-202) Dissolution of turbidity by deionizer resins. Baumann, E.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 20 Feb 1959. Contract AC09-76SR00001. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84005572.

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Laboratory experiments have confirmed that β-$Al_2O_3.3H_2O$, the principal constituent of turbidity, dissolves in the presence of the deionizer resins. The cation resin, Amberlite IR-120-H, can be converted completely to the Al^{+3} form in this way. The anion resin, Amberlite IRA-400-OH, apparently can be only 10 to 20% converted to the AlO_2 form in this way. The rate of dissolution is dependent on the alumina/resin ratio. For an alumina content of 3 wt %, which is the amount found in the resins from the 105-P deionizer3, the rate of cation resin exhaustion will be at most 0.4%/day. This concentration of 3 wt % amounts to more than enough alumina to completely exhaust the cation resin in the deionizer. Removal of turbidity prior to deionization would eliminate this problem, but the long lifetimes of the deionizers currently experienced indicate this is not urgent. However, it is suggested that a given deionizer should not be used intermittently but rather that it should be used continuously to breakthrough, since this dissolution will proceed whether or not the deionizer is on line, once the deionizer contains some turbidity. Also, a deionizer once in service and then out of service for several months should not be counted on to deionizer, since it may become exhausted in the meantime due to dissolution of alumina. This dissolution process is too slow to be a practical method for removal of turbidity from the moderator system.

18495 **(DPST—80-539) Extended service life of Savannah River Plant reactors.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Oct 1980. Contract AC09-76SR00001. 53p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009074.

Reactors at the Savannah River Plant (SRP) have operated for more than twenty-five years without a major incident. Of five reactors originally constructed, three (P, K, and C) have remained in operation, one (R) was shut down in 1964, and plans are underway to restart one (L) that last operated in 1968. These versatile and dependable reactors have been used primarily for production of plutonium and tritium in support of the national defense effort. The lifetime of the N Reactor, on the DOE Hanford Reservation, is projected to end in the early 1990's as a result of distortion of the graphite moderator from radiation damage. This report reviews the SRP reactor systems as they pertain to the expected service life of the complex. Potentially vulnerable areas are identified, and means are discussed to prevent failures or to correct future problems as they arise.

2208 Propulsion Reactors

18496 **(CNLM—2381-6) Materials engineering meeting.** Treciokas, V.P.; Kelly, K.J. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 8 Apr 1960. Contract AC02-84PW02789. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006935.

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Because fibrous materials have the best thermal insulating properties, degassing and stability tests were started with duPont potassium titanate and an alumino-silicate, Fiberfrax. Tests in vacuum have shown that the potassium titanate decomposes at 1800F and is unsatisfactory under these conditions. The material is stable in air at 1800F. The Fiberfrax lost considerable water at 400F and also degases at 1800F. Pelletized Al_2O_3 and ZrO_2 are considerably better than the Fiberfrax. This may due to decreased surface area per bulk density. Tests with Al_2O_3 and ZrO_2 are continuing. Preliminary results based on weight gained by 2000F Cb-1 Zr alloy tabs exposed for 50 hours to flowing argon were obtained concerning the effectiveness of gas purification systems. The data indicate that acceptable gas purity can be obtained from a synthetic zeolite, hot titanium purification system by optimizing gas flow and purifier temperature. Compatability of ZrB_2 with 1800F lithium is good. No metallographic change was observed in sintered ZrB_2 specimens procured from Norton Company following tests of 100, 250 and 1000 hours duration. The specimens tested for 100 and 250 hours exhibited a few radial cracks per specimen believed due to thermal effects. Additional tests at 2100F are scheduled on a recent lot of specimens received from Norton which are reported to be of higher density. Tests with 1800F lithium of higher-density, are-melted specimens prepared at CANEL showed no metallographic change and no cracking.

18497 **(CNLM—2381-12) 31 Mayterials engineering meeting.** Treciokas, V.P.; Kelly, J.P. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 31 May 1960. Contract AC02-84PW02789. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006936.

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18498 **(CNLM—2381-13) Corrosion resistance of materials to lithium.** Kelly, K.J.; Treciokas, V.P. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 29 Jun 1960. Contract AC02-84PW02789. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006937.

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Port-weld, 1 hour heat-treatment of NB-1 Zr alloy welds at temperatures as low as 2000°F were effective in presenting intergranular attack during exposure in 2000°F lithium for 350 hours. Other similar results are given. Lithium reacted with pure uranium dioxide at 2000°F for 50 hours to give lithium and lithium oxide and uranium metal. Beryllium oxide had good corrosion resistance to lithium up to 1800 to 2200°F for 100 to 500 hours; its corrosion resistance was adversely affected by inpurities or increased temperature of lithium. (LTN)

18499 **(CNLM—2381-14) Materials engineering meeting.** Hirakis, E.C. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 18 Jul 1960. Contract AC02-84PW02789. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006938.

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A comprehensive coatings development program is in progress at CANEL. Its objectives are the development of coating materials and methods for the oxidation protection of columbium alloy structural elements in high temperature air operation. The effort is oriented toward the development of a combination of coating properties: impact, erosion and abrasion resistance; high thermal conductivity and ability to withstand steep temperature conditions; resistance to air oxidation at the operating temperature and below; and the ability to retain the described physical and chemical properties for an extended period of time under the combined influence of fluctuating mechanical stress and high temperature environment. The ultimate method sought is further subject to the requirement that it must be applicable to complex structures, but due consideration is given the fact that many less stringent coatings applications exist in the various phases of the CANEL program and these will be dealt with as the coating development work progresses. Although certain coating methods have been stressed in the research work so far completed no effort has yet been made to eliminate any coating process from consideration because of the complex configuration requirement. Rather, all commercial methods are being utilized, and some laboratory processes are being explored. Widely-practiced coating techniques are described.

18500 **(CNLM—2381-15) Materials engineering meeting.** (Pratt and Whitney Aircraft, Middletown, CT (USA)). 11 Aug 1960. Contract AC02-84PW02789. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007010.

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A four inch ingot of Cb-1 Zr alloy, CMS-1830, was cut into two pieces and subsequently fabricated by Universal Cyclops and Haynes Stellite into 0.040" thick sheet with 20 to 40 percent final cold work. Universal Cyclops processed the ingot by warm rolling (1400-1500F) to 0.190" thick material. Further processing to 0.40" thick sheet was done cold with intermediate annealing at 1750F in vacuum. Short Time tensile tests at R.T. and 1800F as well as stress rupture tests in lithium at 1600F and 2000F have been conducted. Material from both vendors meets our existing specification for short time tensile and stress-rupture. Evaluation of the effect of process annealing temperatures on tubing quality showed no significant difference between tubing annealed by CANEL (2200F) or Superior Tube (1800F). Results of engineering group tests and metallurgical investigations group examinations have indicated attack in welds of zirconium-containing alloy specimens fabricated from heats melted and fabricated at CANEL but not in those procured from Wah Chang and fabricated by other vendors. Electron diffraction and additional corrosion tests are under way to determine the reasons behind this anomalous behavior. a specimen of Cb-5 Zr alloy in the pretest (but not heat treated) condition was received and was sectioned for examination. Visual examination showed evidence of porosity and high interstitial content at grain boundaries possibly due to poor quality weld wire. Although early tests of Cb-5 Mo-2 Ti-2 Zr alloy specimens fabricated from Wah Chang heats showed satisfactory corrosion resistance, recent tests from heats melted and fabricated at CANEL showed attack in the form of non-metallic phase in grain boundaries. Specimens of Cb-7 Ti-1 Zr and Cb-20 Ti-5 Zr alloy which were fabricated from CANEL heats also showed attack.

18501 **(CNLM—2381-17) Materials engineering meetings.** (Pratt and Whitney Aircraft, Middletown, CT (USA)). 26 Oct 1960. Contract AC02-84PW02789. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007009.

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A complete materials list was presented specifying the type of material required and its location in the reactor system. Included were lubricants, gases, fuels and coolants as well as the materials required for structural members, shielding, insulation, bearings, seals, pumps, moderators, reflectors, controls, heat exchangers, radiators, and cold traps. These terms are listed in FXM-4304 and FXM-4304, Supplement 2. The operating procedure for the

PWAR-11C was presented with emphasis on the increased time cycle. Additional materials data are required to reflect the increased time at elevated temperature and the additional time required for shutdown.

18502 **(CNLM—2605) Construction of four monoblock seal test stands for endurance testing.** Pearce, M.B. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 23 May 1960. Contract AC02-84PW02789. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007006.

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A relatively simple but reliable seal endurance test start is described. The seal specimen will require oil for cooling and lubrication. In order to facilitate this, it is suggested that the oil system presently located in X526 and X525 be piped to the endurance test area. These oil systems are adequate for the job and should be controlled from the new seal area. Four test vehicles will be oil supplied. Each seal rig requires a maximum of 1 gpm. Four flowmeters are required; two from each oil system. Shop argon should be connected to the test panel for distribution thru flowmeters to each test vehicle. The test panel should be modified to include the instruments and controls shown on Figure 2.

18503 **(CNLM—5302) MCR powerplant study: estimated maximum allowable mixed temperature of potassium from the reheater and secondary heat exchanger for the rematched turbine.** Stewart, O.L. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 11 Oct 1963. Contract AC02-84PW02789. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007050.

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Parametric curves developed for the MCR secondary heat exchanger (primary heater) and reheater for the FT-12 turbine rematched to utilize 15 MW power input indicate the size and weight of these units decreases with increasing potassium exit temperature. Therefore, maximum mixed potassium temperature returning to the intermediate heat exchanger (IHX) is indicated for minimum combined IHX and reheater weight. Neglecting heating due to reflector cooling, the maximum allowable mixed potassium temperature returning to the IHX was estimated based on the assumptions given. The following limiting conditions were calculated: max. reactor coolant flow, lbs/sec 41.4; P across core, psi 37.6; reactor coolant inlet temp., °F 1203.5; Max. potassium mixed return Temp., °F 853.5; and potassium total flow, lbs./sec. 119. Based upon these limiting conditions, the weights of the secondary heat exchanger and reheater, combined weight, and reheater outlet potassium temperature were determined as a function of secondary heat exchanger potassium outlet temperature and are shown in Figure 1. The minimum combined weight occurs at potassium temperatures of approximately 735°F leaving the secondary heat exchanger and 1099°F leaving the reheater. The associated calculations are shown in an appendix.

18504 **(CNLM—5758) Cross reference between existing XM's and new CS's.** Lomerson, E.O. Jr. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 11 Jun 1964. Contract AC02-84PW02789. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007125.

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A cross reference has been tabulated between existing XM specification and newly issued CS specifications. This list may be necessary to identify material specifications in other reports. (LTW)

18505 **(CNLM—5763) Tritium production and Li^8 Bremsstrahlung data.** Sandin, E.V. (Pratt and Whitney Aircraft, Middletown, CT (USA)). 15 Jun 1964. Contract AC02-84PW02789. 3p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007127.

Calculations using recent cross section data for the Li^7 (n, tn) He^4 reaction and including the Li^6 (n, t) He^4 reaction wer made using neutron flux data from a TDC machine calculation. The reactor model used was an early 8 Mw conceptual design. The indicated amounts of tritium produced per Megawatt per hour for each lithium isotope were: from Li^7, 9.6 x 10^{17} atoms/Mw hr, Li^6, 4.2 x 10^{16}. This is a total of approximately 1000 curies for a 10,000 hr, 2.2 Mw test or 4000 curies for a 10,000 hr, 8.8 Mw test. The only readily available data on Li^8 Bremsstrahlung is a calculation of the dose to the payload some 30 feet away from the primary system in a flight configuration. The major source is the boiler due to its small tubes which provide little attenuation in the lithium before the Li^8 betas stike columbium. Scaling this data for the boiler using a $1/R^2$ dependence yields a dose rate of 120 rads/hr 3 feet from the boiler. The dose to the Payload due to the rest of the piping, etc. is about equal to the dose from the boiler so that the dose near any particular pipe will be considerably lower than the dose near the boiler.

18506 **(CNLM—5776) Progress report for 15 June to 19 June 1964.** (Pratt and Whitney Aircraft, Middletown, CT (USA)). 19 Jun 1964. Contract AC02-84PW02789. 2p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007128.

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Preliminary specifications were completed for an 11.2 inch diameter, poison drum controlled reactor with a lithium-cooled side reflector. To meet a 10 percent control requirement, 8 drums in a 6 inch thick side reflector were used. The estimated design weight was 2900 pounds. The components are described briefly and the fission product gases are calculated for 2 x 10^4 megawatt-hours.

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REFER ALSO TO CITATION(S) 18429, 18469, 18482, 19054, 19461, 19579

18507 **(BMI—1983-011) Dynamic soil-structure interactions on embedded buildings.** Kobarg, J.; Werkle, H.; Henseleit, O. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Sep 1983. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750749.

The dynamic soil-structure interaction on the horizontal seismic excitation is investigated on two typical embedded auxiliary buildings of a nuclear power plant. The structure and the soil are modelled by various analytical and numerical methods. Under the condition of the linear viscoelastic theory, i.e. soil characteristic constant in time and independent of strain, the interaction influences between a homogenous soil layer and a structure are analysied for the following parameters: 4) mathematical soil modells; 4) mathematical structure modells; 4) shear wave velocities; 3) embedment conditions; 4) earthquake time histories.

18508 **(CONF-801053—14) Reactor calculation benchmark PCA blind test results.** Kam, F.B.K.; Stallmann, F.W. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007552.

From 8. water reactor safety research information meeting; Gaithersburg, MD, USA (27 Oct 1980).

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Further improvement in calculational procedures or a combination of calculations and measurements is necessary to attain 10 to 15% (1 σ) accuracy for neutron exposure parameters (flux greater than 0.1 MeV, flux greater than 1.0 MeV, and dpa). The calculational modeling of power reactors should be benchmarked in an actual LWR plant to provide final uncertainty estimates for end-of-life predictions and limitations for plant operations. 26 references, 14 figures, 6 tables.

18509 **(EGG-TFBP—6399-Rev.1) PBF-CANDU fuel element LOCA test experiment predictions. Revision 1.** Smith, R.H.; Martinson, Z.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1984. Contract AC07-76ID01570. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008020.

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A loss-of-coolant test sponsored jointly by Ontario Hydro and Atomic Energy of Canada Limited (AECL) will be performed in the Power Burst Facility (PBF) at the Idaho National Engineering Laboratory (INEL). The test will provide both an in-reactor evaluation of CANDU fuel element thermal mechanical behavior during a postulated Loss-of-Coolant Accident and an experimental data base for evaluation of the Canadian transient fuel behavior code, ELOCA. The PFB-CANDU test train is comprised of four

independently shrouded CANDU design fuel elements installed in symmetric orientations in a modified PBF test assembly. Three of the fuel elements were preirradiated in the NRX reactor to approximately 5000 MWd/t (120 MWh/kgU) at ~ 53 kW/m, and the fourth fuel element is unirradiated.

18510 **(GKSS—83/E/28) Description of decay-heat removal pump test facility of GKSS.** Domann, H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750744.

The following report describes the test facility of GKSS for a decay heat removal pump. In this facility the cavitation behaviour of an original decay-heat removal pump (Type BIBLIS B) under loss-of-coolant accident conditions will be studied. This report presents the mechanical details of the test loop and the pump including all auxiliary systems and shows the operational and design data of the facility.

18511 **(GRS-F—127) List of reports concerning reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Jul 1983. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750731.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning special problems in the field of Reactor Safety Research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commissariat a l' Energie Atomique (CEA), the Japan Science and Technology Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these Reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Programm of the BMFT, reporting organization. The list of reports appears quarterly.

18512 **(HEDL-SA—3074-S) Attenuation mechanisms in the transport of in-vessel radiological source term fission products in an LMFBR.** Woodley, R.E.; Nguyen, D.H.; Hunter, C.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76FF02170. 5p. (CONF-840701—9). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008346.

From Topical meeting on fission product behavior and source term research; Snowbird, UT, USA (15 Jul 1984).

Quantifying the release of radiological source term fission products from an LMFBR reactor vessel (RV) is a necessary input to the containment analysis. To estimate this initial source term value, the distribution of the fission products and actinides inside the RV, prior to release, must be known. The in-vessel source term fission product distribution and transport behavior is also essential in assessing and mitigating the plant contamination and cleanup problems which occur from any significant core disruption. This paper attempts to summarize the current knowledge on the behavior of several radioisotopes in different environments created by the accident, without dealing with the modeling of the transport process itself.

18513 **(IKE—2-61) Investigations on steady-state and transient fuel rod and cluster behavior during severe fuel damage condition.** Bisanz, R.; Lang, U.; Scheuermann, W.; Unger, H. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Jan 1983. 146p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750864.

The SUPER SARA experiments are intended to cover a wide range of accident sequences with severely damaged fuel rods in light water reactors. The cluster behavior is a complicated function of material compositions, thermalhydraulic and reactor physical conditions. Within the frame of the SUPER SARA project investigations have been performed in order to support the thermalhydraulic and geometrical design. The modular program systems RSYST, SSYST, EXMEL and MELSIM2 have been applied in order to analyze the fuel rod and cluster behavior for various power levels and inlet mass flow histories. Based on the results obtained, sensitive parameters and proposals for future theoretical and experimental research activities have been concluded. Future applications of the Safety Analysis System (SASYST) will allow a comprehensive analysis of the physical phenomena considered, e. g. coupled reactor physics, structural mechanics, thermalhydraulics and cluster behavior calculations.

18514 **(JAERI-M—82-094) Verification of LOCA/ECCS analysis codes ALARM-B2 and THYDE-B1 by comparison with RELAP4/MOD6/U4/J3.** Shimizu, Takashi. (Japan Atomic Energy Research Inst., Tokyo). Aug 1982. 108p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700096.

For a verification study of ALARM-B2 code and THYDE-B1 code which are the component of the JAERI code system for evaluation of BWR ECCS performance, calculations for typical small and large break LOCA in BWR were done, and compared with those by RELAP4/MOD6/U4/J3 code. This report describes the influences of differences between the analytical models incorporated in the individual code and the problems identified by this verification study.

18515 **(JAERI-M—82-124) Blowdown force analysis of piping system under LOCA conditions using BLOWDOWN code.** Miyazaki, Noriyuki; Akimoto, Takashi. (Japan Atomic Energy Research Inst., Tokyo). Sep 1982. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700098.

The BLOWDOWN code was developed for the blowdown force analysis of the piping system under the LOCA conditions. This is a post-processor of the thermal-hydraulic analysis code RELAP4/MOD6. The results obtained from the RELAP4/MOD6 code are converted into the blowdown forces by the BLOWDOWN code. In the paper is described the outline of the BLOWDOWN code. Some numerical examples are also presented to show the effectiveness and limitation of the code.

18516 **(Juel-Spez—199) Nuclear process heat system AVR-II.** Fassbender, J.; Altes, J.; Becker, S.; Bongartz, R.; Breitbach, G.; David, P.H.; Ehrhardt, K.D.; Hennings, W.; Jahn, W.; Katscher, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). Mar 1983. 231p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84750745.

Concerning safety features, the AVR-II differs appreciably from the comprehensive systems with thermal output of several hundred megawatts that have been examined so far. The essential differences are: slender steel pressure vessel instead of a prestressed-concrete vessel; no seperate afterheat removal system; afterheat removal is possible through steel pressure vessel surface; control and shutdown over reflector rods only; little redundance of operational systems; simplified containment; areal cooler to cool the reactor cavern. Safety is basically founded on passive system characteristics; the requirements on active safety devices may therefore be reduced. The different plant design requires appropriate changes in the spectrum of incidents; in particular, there is a shift in the importance of certain typer of incidents.

18517 **(Juel-Spez—212) FRESCO-II: A computer program for analysis of fission product release from spherical HTGR-fuel elements in irradiation and annealing experiments.** Krohn, H.; Finken, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). Jun 1983. 61p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750863.

The modular computer code FRESCO has been developed to describe the mechanism of fission product release from a HTGR-Core under accident conditions. By changing some program modules it has been extended to take into account the transport phenomena (i.e. recoil) too, which only occur under reactor operating conditions and during the irradiation experiments. For this report,

the release of cesium and strontium from three HTGR-fuel elements has been evaluated and compared with the experimental data. The results show that the measured release can be described by the considered models.

18518 **(KAERI/RR—362/82) Study on the reliability and risk assessment of nuclear power plants.** Hwang, W.K.; Kim, H.D. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 150p. (In Korean). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84700100.

The final objective of the present study is to establish the foundations of both performing statistical analyses of various failures and potential accidents in nuclear power plants and assessing probabilistic safety. In order to achive the objective, we have chosen the review of the state of the arts in the related methodologies and the establishment of reliability analysis method as study areas in this year. The works performed are summalized here. First, the brief reviews of the present status on the Probabilistic Risk Assessment and the development of quantiative safety goal in the Unite States were completed. It has been identified that the Probabilistic Risk Assessment techniques will take important role in nuclear safety assessment as a supporting tool in coming years. In order to establish reliability analysis methodology, a computer code for updating plant specific reliability data has been developed as a part of this project. A reliability analysis system has been estabished and used to analyize the axiliary feedwater system.

18519 **(KAERI/RR—382/82) Reactor operational transient analysis.** Shin, W.K.; Chae, S.K.; Han, K.I.; Yang, K.S.; Chung, H. D.; Kim, H.G.; Moon, H.J.; Ryu, Y.H. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 103p. (In Korean). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700102.

To build up efficient capability of safety review and inspection for the nuclear power plants, four areas of study have been performed as follows: 1) In order to search for the most optimized operating method during load follow operating schemes, automatic control and normal control, are compared to each other under the CAOC condition. The analysis performed by DDID code has shown that the reactor has to be controlled by the operator manually during load follow operation. 2) Through the sensitivity analysis by COBRA code, the operating parameters, such as coolant pressure, flow rate, inlet temperature, and power distribution are shown to be important to the determination of DNBR. Especially, the inlet temperature of primary coolant system which has appeared as the most senstive parameter on DNBR. 3) FRAPCON code is adapted to study the sensitivity of several operational parameters on the mechanical properties of reactor fuel rod. 4) The calculations procedure which is required to obtain the neutron fluence at the reactor vessel and the spectrum at the surveillance capsule is established. The results of computation are conpared with those of FSAR and SWRI report and proved its applicability to reactor surveillance program.

18520 **(KFK—3507) Temperature escalation in PWR fuel rod simulators due to the zircaloy/steam reaction: Tests ESSI-1,2,3.** Hagen, S.; Malauschek, H.; Wallenfels, K.P.; Peck, S.O. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Aug 1983. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750874.

This report discusses the test conduct, results, and posttest appearance of three scoping tests (ESSI-1,2,3) investigating temperature escalation in zircaloy clad fuel rods. The experiments are part of an out-of-pile program using electrically heated fuel rod simulators to investigate PWR fuel element behavior up to temperatures of 2000°C. These experiments are part of the PNS Severe Fuel Damage Program. The temperature escalation is caused by the exothermal zircaloy/steam reaction, whose reaction rate increases exponentially with the temperature. The tests were performed using different initial oxide layers as a major parameter, obtained by varying the heatup rates and steam exposure times.

18521 **(NUREG—0606-Vol.6-No.1) Unresolved safety issues summary. Aqua book. Vol. 6, No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Mar 1984. 104p. NTIS, PC A06/MF A01 - GPO. Order Number DE84900877.

The Unresolved Safety Issues summary is designed to provide the management of the Nuclear Regulatory Commission with a quarterly overview of the progress and plans for completion of generic tasks addressing unresolved safety issues reported to Congress pursuant to Section 210 of the Energy Reorganization Act of 1974 as amended. The schedules in this book include a milestone at the end of each action plan which represents the initiation of the implementation process both with respect to incorporation of the technical resolution in the NRC official guidance or requirements and also the application of changes to individual operating plants.

18522 **(NUREG—0978) Mark III LOCA-related hydrodynamic load definition. Generic technical activity B-10.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Feb 1984. 122p. NTIS, PC A06 - GPO. Order Number DE84900860.

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This report, prepared by the staff of the Office of Nuclear Reactor Regulation and its consultants at the Brookhaven National Laboratory, provides a discussion of LOCA-related suppression pool hydrodynamic loads in boiling water reactor (BWR) facilities with the Mark III pressure-suppression containment design. Its issuance completes NRC Generic Technical Activity B-10, Behavior of BWR Mark III Containment. On the basis of certain large-scale tests conducted between 1973 and 1979, the General Electric Company developed LOCA-related hydrodynamic load definitions for use in the design of the standard Mark III containment. The staff and its consultants have reviewed these load definitions and their bases conclude that, with a few specified changes, the proposed load definitions provide conservative loading conditions. The staff-approved acceptance criteria for LOCA-related hydrodynamic loads are provided in Appendix C of this report.

18523 **(NUREG—1039) Review and evaluation of the Nuclear Regulatory Commission Safety Research Program for fiscal year 1985. A report to the Congress of the United States of America.** (Nuclear Regulatory Commission, Washington, DC (USA). Advisory Committee on Reactor Safeguards). Feb 1984. 72p. NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE84900862.

This is the seventh report by the Advisory Committee on Reactor Safeguards (ACRS) in response to the Congressional requirement for an annual report on the Nuclear Regulatory Commission (NRC) Reactor Safety Research Program. As previously requested by the Congress, the timing of this report has been adjusted to enable the ACRS to address the proposed budget for FY 1985 that has been submitted to the Congress by the President. Part I is a compilation of our comments and recommendations regarding the NRC Safety Research Program budget for FY 1985. It is intended to serve as an Executive Summary. Part II is divided into eight chapters, each of which represents a Decision Unit of the NRC research program. In each chapter, specific comments are included on the research involved in the Decision Unit, an assessment of priorities, and recommendations regarding new directions and levels of funding.

18524 **(NUREG/BR—0051-Vol.5-No.5) Power Reactor Events, September-October 1983.** Massaro, S.A. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA)). Feb 1984. 37p. NTIS, PC A03/MF A01 - GPO. Order Number DE84900863.

Power Reactor Events ia a bi-monthly newsletter that compiles operating experience information about commercial nuclear power plants. This includes summaries of noteworthy events and listings and/or abstracts of USNRC and other documents that discuss safety-related or possible generic issues. It is intended to feed back some of the lessons learned from operational experience to the various plant personnel, i.e., managers, licensed reactor operators, training coordinators, and support personnel.

18525 (NUREG/CP—0041-Vol.1) **Tenth water reactor safety research information meeting: proceedings. Volume 1.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1983. 440p. (CONF-821037—Vol.1). NTIS, PC A19/MF A01 - GPO $11.00. Order Number DE83901318.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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Separate abstracts were prepared for papers presented in the follwoing areas: (1) Plenary Session; (2) Integral Systems Experiments; (3) Separate Effects Experimental Programs; (4) Model Development Expeirmental Programs; (5) 2D/3D Research Programs; and (6) Foreign Programs in Thermal Hydraulics.

18526 (NUREG/CP—0041-Vol.1, pp 20-37) **Scaling rationale in reactor safety research.** Tong, L.S. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The requirement of a sound and valid scaling rationale is necessary for application of the scaled experimental results to a real industrial plant. It is particularly important in reactor safety research, because the results of simulated severe accident tests are not expected to be checked in an actual reactor and thus the wrongly scaled experimental data could mislead the reactor designer or operator to an unsafe condition. Research results are now being applied to safety analysis. The work scaling is used here in a very broad sense. This paper is to review the existing scaling rationale (or simulation criteria) of research in the field of thermal-hydraulics, structure, and metallurgy; and to call researchers' attention to the scaling rationale in future reactor safety research efforts.

18527 (NUREG/CP—0041-Vol.1, pp 53-59) **Semiscale Program FY 82-83 highlights.** Shimeck, D.J. (EG and G Idaho, Inc., Idaho Falls). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1). Contract AC07-76ID01570.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Semiscale Program and test facility are located at the Idaho National Engineering Laboratory and operated by EG and G Idaho for the US Department of Energy. The system is a small-scale model of the primary coolant system of a pressurized water reactor (PWR) nuclear generating plant. It incorporates the major components of a PWR and is capable of attaining typical operating pressures and temperatures. Experiments and analyses conducted by the Semiscale Program in the past year have encompassed a number of water reactor safety issues. Efforts continued on completing the analysis of extensive natural circulation cooling experiments performed in FY-81. Effort was also extended toward analyzing data from numerous small-break loss-of-coolant experiments performed since the TMI-2 accident. Recent results from this effort have highlighted the value of experimental results in validating computer code capabilities. In terms of new experimental work, three test series were performed: an intermediate break series, secondary side feedwater and steam line breaks, and primary coolant system feed and bleed experiments. Each is briefly reviewed.

18528 (NUREG/CP—0041-Vol.1, pp 60-70) **Experiment design and scaling analysis for the BWR FIST.** Thompson, J.E.; Findlay, J.A.; Sutherland, W.A. (General Electric Co., San Jose, CA). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Full Integral Simulation Test (FIST) program is an extension of BWR safety technology into the areas of small break LOCAs and operational transients. To tie back with the existing data base, design basis accident LOCAs will also be performed. The FIST facility is an integral system capable of full power steady state operation and real time simulation of transients, including power excursions and/or degraded systems. It is a full height simulation of the reactor vessel and internals with scaled regional volumes, and includes all major interfacing systems and automatic trip signals. Combined with a full size electrically heated bundle, this provides full scale values for fluid conditions, velocities, and static heads. The program provides data for evaluation of the governing phenomena, for development and qualification of thermal hydraulic methods, and for evaluation of reactor system operating information. Factors considered in the design of the FIST facility include BWR design features important to scaling, the system parameters and phenomena which must be accurately simulated, and experience gained from design of previous scaled facilities.

18529 (NUREG/CP—0041-Vol.1, pp 71-90) **LOBI experimental program results and plans: status September 1982.** Riebold, W.L.; Piplies, L.; Staedtke, H. (Commission of the European Communities, Ispra, Italy). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The LOBI Project is being executed in the framework of an R and D contract between the Bundesminister fuer Forschung und Technologie, Bonn/FRG, and the Commission of the European Communities. The LOBI test facility was built and is operated by the EURATOM Joint Research Centre in Ispra, Italy; it is at present the only high-pressure integral system test facility in Europe for the investigation of pressurized water reactor loss-of-coolant accidents. The paper aims at highlighting the analysis results obtained until now from the LOBI Program by: (10 considering the influence of three important test parameters on blowdown, (2) showing the test predicting capability of the RELAP4/MOD6 code and (3) illustrating the importance of pump behavior simulation. The three test parameters investigated are: (1) the ECC water injection mode which was varied between cold leg injection, combined coal and hot leg injection and no injection at all, (2) the break size which ranged from 2 x 1A down to 1 x 0.25A, and (3) the downcomer gap width of 50 and 12 mm. A short outline of the presented status of the LOBI Project and of the plans for the forthcoming experimental program concludes the paper.

18530 (NUREG/CP—0041-Vol.1, pp 91-94d) **ROSA-III Program for BWR LOCA/ECCS integral test.** Tasaka, K.; Suzuki, M.; Anoda, Y.; Kumamaru, H.; Nakamura, H.; Yonomoto, T.; Shiba, M. (Japan Atomic Energy Research Inst., Tokai-mura, Ibaraki-ken). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Japan Atomic Energy Research Institute (JAERI) initiated the Rig of Safety Assessment Number 3 (ROSA-III) program in 1978 to conduct an integral system effect test of a loss-of-coolant accident (LOCA) in a boiling water reactor (BWR) to study the fundamental thermal-hydraulic phenomena during a LOCA and the effectiveness of the emergency core cooling system (ECCS). The objectives of the ROAS-III program are: (1) to study the BWR LOCA scenario comprehensively varying the test conditions on the break, ECCS and other parameters; (2) to identify any problem area or unexpected phenomena in a BWR LOCA; and (3) to provide experimental data for the computer code assessment.

18531 (NUREG/CP—0041-Vol.1, pp 95-107) **Summary of two-bundle loop experimental results.** Naitoh, M. (Hitachi Ltd., Ibaraki, Japan); Murase, M.; Tsutsumi, R. Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

BWR loss of coolant integral tests are being conducted as a joint study program of Japan BWR utilities, Hitachi Ltd., and Toshiba Corporation. The first series of the tests, which were focused on the simulation of a recirculation line break, has been finished. And the facility is now being modified for the second series of the tests to simulate other breaks of a feed water line, a core spray line, and a drain line from a recirculation line. The second tests will start at January 1983. This paper presents the results of the first test series. The facility (TBL-1) simulates a reference BWR/5-251 plant with 764 fuel bundles by 2 heater bundles. The TBL-1 test parameters were a break diameter, a bundle power combination, and an ECCS operation mode.

18532 (NUREG/CP—0041-Vol.1, pp 108-117) **French integral loop, a joint CEA-EDF-FRAMATOME project.** Deruaz, R. (CEA Centre d'Etudes Nucleaires de Grenoble, France); Megnin, J.C. Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Because of the rather large number of PWR type reactors in operation, under construction; or planned in France, the partners of the French nuclear program CEA-EDF and FRAMATOM are closely concerned with nuclear safety problems. With regard to the thermal-hydraulic behavior of reactors in accidental or incidental situations, several tools are currently being developed. Included are: (1) the safety code CATHARE which is developed within the above-mentioned three-party framework and supported by a program of analytical experiments which has been undertaken several years ago and (2) accidental sequence simulators which are derived from CATHARE or other two phase models and aim at training operators and qualifying operating procedures. In this context and as a complement to current work in thermalhydraulics related to nuclear safety, CEA-EDF and FRAMATOME are planning to build an integral loop, which will be used in the investigation of post-accidental situations where the primary coolant is in two-phase state and during which the action of operators is likely to help the plan in returning to a safe condition. The planned facility is described.

18533 (NUREG/CP—0041-Vol.1, pp 118-120) **Eighteen degree sector test apparatus (ESTA) test results.** Nagasaka, H.; Katoh, M.; Onodera, I.; Aoki, H. Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Eighteen degree sector test apparatus (ESTA), which mocks up BWR plant, has been constructed and refill-reflood phenomena during LOCA conditions have been studied. The objective of this study is to confirm the conservatism of current safety evaluation models and to present the data base for best estimate code qualification and verification. ESTA is full height from jet pump bottom to standpipe top and main components within shroud are cut into an 18° sector.

18534 (NUREG/CP—0041-Vol.1, pp 121-140) **PKL system effects test - status of PKL II tests.** Brand, B.; Liebert, H.; Mandl, R.; Sarkar, J. (Kraftwerk Union AG, Erlangen, Germany). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The PKL test facility is a scaled down model of a 1300 MWe KWU PWR primary system for the investigation of the low pressure phase of a LOCA. The PKL system represents all primary components including reactor pressure vessel, downcomer and 3 loops with steam generators and pump simulators. The design pressure of 40 bar allows to simulate large break LOCA conditions including the end-of-blowdown phase and the refill reflood phase so that the accumulator injection at 26 bar can be simulated. Due to the high pressure level, also an interesting phase during a small break LOCA, can be investigated. Results of shakedown tests on modifications of the system are presented.

18535 (NUREG/CP—0041-Vol.1, pp 152-179) **NRC/EPRI/W FLECHT-SEASET program: natural circulation results - 163-blocked bundle results.** Hochreiter, L.E. (Westinghouse Electric Corp., Pittsburgh, PA). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The FLECHT-SEASET program is a cooperative research and development program between the US NRC, EPRI, and Westinghouse. The goals of the program are to examine flow blockage heat transfer to address large break LOCA concerns, as well as to examine the different cooling modes in natural circulation. The objective of this task is to examine the systems response and steam generator heat transfer for different natural circulation cooling modes. The test series is specifically designed to address post TMI-Accident and accident recovery concerns. The experiments have investigated the different natural circulation cooling modes as well as the transition between modes. The test facility was originally designed for reflood heat transfer systems effects tests, however, nearly all the scaling requirements for natural circulation are the same as those for reflood with the exception of system pressure. The test facility is full height, has PWR resistances and preserves the proper power-to-volume ratio. An active secondary side has been added to the two full height steam generators such that a forced flow or boiling secondary side in the steam generators can be used.

18536 (NUREG/CP—0041-Vol.1, pp 180-187) **Heat transfer from a vertical tube bundle under natural circulation conditions.** Gruszczynski, M.J.; Viskanta, R. (Purdue Univ., West Lafayette, IN). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This paper highlights results of work covering steady-state and transient heat transfer for longitudinal flow of water outside a vertical tube bundle (rods) under natural convection circulation conditions. This type of fundamental information is needed for realistic modeling of the thermal-hydraulic behavior of light water nuclear reactors under transient or accident conditions. It is also necessary for the development of computer models to simulate a wide range of postulated nuclear reactor accidents in order to gain insight into measures that can be taken to improve reactor safety.

18537 (NUREG/CP—0041-Vol.1, pp 202-217) **Payoffs from the BWR refill/reflood program.** Findlay, J.A.; Sutherland, W.A. (General Electric Co., San Jose, CA). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Results from the Refill/Reflood Program provide an extensive full scale, multi-channel, multi-dimensional data base of system performance under LOCA conditions. The data show the two-phase hydrodynamic parallel channel behavior that occurs in an array of multiple channels when there is a two-phase level in the lower plenum. The data show the regional mixing and steam condensation of subcooled ECCS water injected into the system. The effectiveness of the ECC Systems and the beneficial effects of the multi-dimensional phenomena are demonstrated. The understanding of controlling phenomena that has been gained from this program has contributed substantially to the development of the BWR multi-dimensional best estimate analysis model, and the data base that has been obtained provides an important source for qualification of this model. A principal payoff from the program is its contribution to the closure of BWR LOCA issues by demonstrating effective core reflooding and providing the technology for greater confidence in calculation of LOCA consequences.

18538 (NUREG/CP—0041-Vol.1, pp 232-252) **Phenomenological modeling of two-phase flow in water reactor at ANL (inverted annular flow modeling).** Ishii, M.; De Jarlais, G. (Argonne National Lab., IL). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

In predicting two-phase flow phenomena in nuclear reactors under various accident conditions, the interfacial transfer terms are among the most essential factors in the modeling. The interfacial geometry and thermo-hydraulics at the interface often dominate these two-phase flow phenomena. Among the various two-phase flow regimes, the inverted annular flow is relatively less well understood due to its special heat transfer conditions. However, this regime is quite important in terms of LWR accident analyses, since the peak cladding temperature often strongly depends on the thermo-hydraulics in this inverted annular flow and subsequent droplet dispersed flow. In view of this, the inverted annular flow transfer mechanisms and the flow regime transitions are studied in detail.

18539 (NUREG/CP—0041-Vol.1, pp 253-274) **LDA in situ study of droplet hydrodynamics across grid spacers in PWR-LOCA reflood.** Lee, S.L.; Cho, S.K.; Rob, K.; Sheen, H.J.; Aghili, M. (State Univ. of New York, Stony Brook). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

One of the improved heat transfer mechanisms in the case of hot, dry-wall cooling is bottom flooding. In this technique, the hot, dry-wall is cooled initially by a parallel vapor stream carrying droplets of mostly a few millimeters in size which are entirely generated from the bottom, based on the critical Weber number. Therefore, the cooling is believed to be done primarily by the convection of superheated steam on the assumption of a lack of sufficient population of smaller droplets which usually serve as more efficient cooling agents due to their large surface area to volume ratios. The thermally relatively inactive large droplets (> 1mm) can be broken down to more active smaller droplets ($< 100\mu$) using grid spacers located at equal intervals along the entire length of the bundle. Large droplets intercepted by each grid spacer produce a large number of small droplets downstream. The effect of this phenomenon is observed by a sharp dip of the cladding temperature downstream of all grid spacers. Hence, a direct verification of this suggested mechanism of transformation of mist flow across the grid spacer plate is in order. The objectives of this task is to develop correlations for the effect of grid spacers. In detail, they are classified as follows: (1) develop correlations to predict the rates of droplets reentrainment in concurrent two-phase flow; (2) develop correlations for predicting interfacial area density in dispersed flow regimes; and (3) provide data on droplet size distribution, droplet velocity and gas velocity.

18540 (NUREG/CP—0041-Vol.1, pp 275-286) **Findings in CCTF core I test.** Murao, Y.; Sudoh, T.; Iguchi, T.; Sugimoto, J.; Akimoto, H.; Okubo, T.; Hirano, K. (Japan Atomic Energy Research Inst., Tokai-mura, Ibaraki-ken). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Cylindrical Core Test Facility (CCTF) is one of the facilities of the Large Scale Reflood Test Program which was initiated in April 1976. The first series of the CCTF test is named CCTF CORE I TEST and was completed in April, 1981. In the test, the following has been examined: (1) the conservativeness of the assumption of the safety analysis with the evaluation model (EM) code; (2) the safety margin on the peak clad temperature; and (3) the validity of the models in the EM code and the present BE code for application to the BE code development. For this intention, the twenty-seven runs including the shakedown tests were performed under the various conditions covering the wide spectrum of the refill and reflood phases and analyzed by comparing the results with the results of the reference test, called the base case test and with the results predicted with EM codes, REFLA and TRAC codes. In this paper, the following items are discussed: (1) one-dimensional treatment of the core hydrodynamics in EM codes; (2) conservativeness of the heat transfer model of EM codes; (3) safety margin of the peak clad temperature; and (4) conservativeness of the downcomer hydrodynamic model.

18541 (NUREG/CP—0041-Vol.1, pp 287-306) **SCTF core-I reflood test results.** Adachi, H.; Sudo, Y.; Sobajima, M.; Iwamura, T.; Osakabe, M.; Ohnuki, A.; Abe, Y.; Hirano, K. (Japan Atomic Energy Research Inst., Tokai-mura, Ibaraki-ken). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

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Slab Core Test Facility (SCTF) Test Program is being performed at Japan Atomic Energy Research Institute (JAERI) as one of the subprograms of Large Scale Reflood Test program. In Cylinderical Core Test Facility (CCTF) Test program, another part of the Large Scale Reflood Test program, system behavior simulation for the last part of blowdown, refill and reflood phases of a LOCA in an actual pressurized water reactor (PWR) is the primary concern. On the other hand, the major objectives in the SCTF Test Program are to clarify the following items: (1) two-dimensional thermo-hydrodynamics in a wide core (chimney effect, sputtering effect, blockage effect); (2) flow interaction between core and upper plenum (fall back, core entrainment); and (3) hot leg carryover characteristics (upper plenum entrainment/de-entrainment, counter current flow in hot leg. In 1981, thirteen forced-feed flooding tests including two shakedown tests were performed, in which the downcomer was isolated from the lower plenum by inserting a blind plate and emergency core cooling (ECC) water was injected directly into the lower plenum. Results from the system pressure effect tests in the forced-feed flooding test series were introduced at the Ninth Water Reactor Safety Research Information Meeting. In the present report, chimney effect, blockage effect and hot leg carryover characteristics are discussed based on the data from the other tests in the series.

18542 (NUREG/CP—0041-Vol.1, pp 347-352) **TRAC-BD1 calculation for two-bundle loop integral response.** Naitoh, M. (Hitachi Ltd., Ibaraki, Japan); Matsumoto, T.; Murase, M.; Tsutsumi, R. Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The two-bundle loop (TBL) facility was constructed to obtain an integral system response during loss-of-coolant conditions in a BWR. The facility consists of two full size electrically heated bundles and two full length jet pumps. TRAC-BD1 is an advanced best estimate computer program for BWR LOCA analysis. This program is used to simulate the Run 106 test data obtained in the TBL. Preliminary results of this activity are given here. Run 106 simulates a guillotine break of the recirculation pipe with an assumption of a low pressure core injection (LPCI) diesel generator single failure.

18543 (NUREG/CP—0041-Vol.1, pp 353-355) **ROSA-IV Program for the experimental study on small-break LOCA's and the related transients in a PWR.** Tasaka, K. (Japan Atomic Energy Research Inst., Tokai-mura, Ibaraki-ken). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The emphasis in light water reactor safety research, since the TMI-2 accident, has been on small break loss-of-coolant accidents (SBLOCA's) and transients. The Japan Atomic Energy Research Institute (JAERI) has initiated the Rig of Safety Assessment Number 4 (ROSA-IV) program for study in these areas. The ROSA-IV program consists of the Large Scale Test Facility for system effects tests and the Two-Phase Test Facility for separate effects tests. Experimental results from these facilities will be used to develop and assess a computer code to be used in the analysis of SBLOCA's and transients. The scope objectives and present status of the program are presented.

18544 (NUREG/CP—0041-Vol.1, pp 356-358) **TRAC-BD1 calculation of ESTA test.** Abe, N.; Katoh, M.; Nagasaka, H.; Aoki, H. Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This paper describes analytical results of BWR upper plenum behavior under LOCA using TRAC-BD1 code and comparison with ESTA (Eighteen Degree Sector Test Apparatus) results. TRAC-BD1 is a best estimate system code and features a three dimensional treatment of the BWR pressure vessel and a one dimensional treatment of fuel bundles and pipings. ESTA is the BWR LOCA refill-reflood test facility which mocks up an 18 degrees sector of the BWR with full height from jet pump bottom to standpipe top. The objective of this study is to verify the predictive capability of the TRAC-BD1 code through the analysis of ESTA saturated CCFL tests with special emphasis on multi-dimensional nonequilibrium two phase flow behavior.

18545 (NUREG/CP—0041-Vol.1, pp 359-362) **CATHARE code and its qualification on analytical experiments.** Houdayer, G.; Rousseau, J.C.; Brun, B. (Centre d'Etudes Nucleaires de Grenoble, France). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

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CATHARE is an advanced safety code developed by CEA, EDF and FRAMTOME to simulate LOCA on PWR (large and small breaks). It is being done by a joint team (in Grenoble) which is in charge of the experiments analysis, modelling, code writing and assessment. Associated with code development, an experimental program is performed to study the phenomena occurring during LOCAs. The experimental results are used to qualify and verify the code. The code has to combine and transpose the phenomena occurring in the reactor and then allows safety studies at reactor scale.

18546 (NUREG/CP—0041-Vol.1, pp 363-374) **NEPTUN bundle boil-off and reflooding experimental program results.** Aksan, S.N. (Swiss Federal Inst., Wuerenlingen, Switzerland). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The NEPTUN test facility is located at the Swiss Federal Institute for Reactor Research (EIR) in Wuerenlingen, Switzerland. The NEPTUN system was initially designed to provide data from low pressure (< 5 bar) reflood experiments investigating heat transfer from rod to coolant and the thermal-hydraulic response of the cooling water in a pressurized water reactor (PWR) core. In addition to reflooding experiments, core uncovery (boil-off) experiments to investigate the mixture decrease and resulting fuel rod heat up above the mixture level that may occur in a PWR during a small break loss-of-coolant accident (LOCA) have been performed in the NEPTUN test facility. The reflooding and boil-off experiment data obtained from NEPTUN facility is going to be used in assessing the models developed and may also lead to new model development. The specific objectives of the tests are also related to Loss of Fluid Test (LOFT) data needs. These objectives special interest to LOFT are: to obtain electric rod reflood data applicable to LOFT for assessing reflood models; to develop and verify heat transfer and fluid carry-over correlations to be used in the above models; to obtain data characterizing LOFT core uncovery response during a small break loss of coolant experiment; to evaluate the accuracy and selective cooling effects of the LOFT cladding-surface thermocouples under reflood and small break core uncovery conditions; and to obtain information on electrical heater rod versus nuclear fuel rod performance during reflood and boil-off conditions.

18547 (NUREG/CP—0041-Vol.1, pp 375-429) **HDR core barrel dynamics for large and small breaks including nonlinear structural impact phenomena.** Wolf, L. (Kernforschungszentrum, Karlsruhe, Germany). Jan 1983. NTIS, PC A19/MF A01 - GPO $11.00. (CONF-821037—Vol.1).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This paper summarizes and compares the experimental as well as pretest calculational results of the four last blowdown tests, V31.2, V32, V33 and V34, with reactor pressure vessel internals (RPV-I) at the HDR-facility. These four tests constitute the Main Test Series of the RPV-I experiments and conclude the experimental efforts during Phase I of the overall HDR-Safety Program at the same time.

18548 (NUREG/CP—0041-Vol.2) **Tenth water reactor safety research information meeting: proceedings. Volume 2.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1983. 502p. (CONF-821037—Vol.2). NTIS, PC A22/MF A01 - GPO $11.00. Order Number DE83901317.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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Separate abstracts were prepared for papers presented in the following areas: (1) Analysis of Trnasients in Light Water Reactors; (2) Fuel Behavior and Fission Product Release; (3) Severe Accident Assessment; and (4) Severe Accident Sequence Analysis.

18549 (NUREG/CP—0041-Vol.2, pp 24-28) **Nuclear plant analyzer development at Los Alamos.** Liles, D. (Los Alamos National Lab., NM). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

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The accident at Three Mile Island (TMI) changed the primary emphasis in nuclear reactor safety research from large-break LOCAs to the entire spectrum of reactor accidents including small-break LOCAs, ATWS, operational transients, and other transients or accidents that eventually might cause an inability to cool the core. Since that accident, much progress has been made on advanced best-estimate computer codes to analyze system transients. Consequently, a code such as TRAC-PFl can run reliably a wide variety of both slowly and rapidly developing accidents including those involving core uncovery and reflood. TRAC was the first computer code capable of running in one continuous calculation an entire large-break LOCA sequence including blowdown, refill and reflood. A discussion of the code and planned computer simulation capabilities is presented.

18550 (NUREG/CP—0041-Vol.2, pp 29-38) **Nuclear Plant Data Bank and input deck preparation.** Kopp, H. Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

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The Nuclear Plant Data Bank is a computer-based system that organizes a nuclear power plant's technical data, providing mechanisms for data storage, retrieval and computer-aided engineering analysis. It has the specific objective to describe-thermohydraulic and containment systems in order to support rapid information retrieval and display and thermohydraulic analysis modeling. The current application supports thermohydraulic analysis of reactor safety systems including all fluid passages and containment structures.

18551 (NUREG/CP—0041-Vol.2, pp 39-47) **Calculations of pressurized thermal shock transients in B and W plants.** Basett, B.; DeMuth, N.S.; Elliott, J.L. (Los Alamos National Lab., NM). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

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Analysis to help determine the risk of pressurized thermal shock (PTS) to the reactor vessel is in progress for the Oconee-1 B and W power plant, using the Transient Reactor Analysis Code (TRAC). Extensive effort has been put into developing a TRAC model, and production runs are now beginning. The concern over PTS arises because the material properties of the vessel wall change after several years of irradiation. The vessel wall becomes embrittled and its nil-ductility temperature (NDT) increases. If during an accident, cold liquid from the high-pressure injection system cools the vessel wall below the NDT and the system subsequently repressurizes, the possibility exists that defects could be initiated or propagated in the vessel wall.

18552 (NUREG/CP—0041-Vol.2, pp 48-56) **RELAP5 calculations for a Babcock and Wilcox plant of pressurized thermal shock transients.** Peterson, A.C. (EG and G Idaho, Inc., Idaho Falls). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2). Contract AC07-76ID01570.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The possibility of reactor vessel failure due to a severe pressurized overcooling event has been identified as an unresolved safety issue (USI) by Nuclear Regulatory Commission (NRC). This USI has been identified by the NRC as Task A-49 Pressurized Thermal Shock. In support of the resolution of the pressurized thermal shock USI, calculations of the thermal-hydraulic conditions during selected overcooling transients for the Oconee 1 pressurized water reactor (PWR) were performed using the RELAP5 comput-

er code. The Oconee 1 PWR is a Babcock and Wilcox designed nuclear steam supply system. The transients calculated were a main steam line break, a steam generator overfeed, and a small hot leg loss-of-coolant accident. Four additional transients will be calculated.

18553 (NUREG/CP—0041-Vol.2, pp 57-75) **COBRA/TRAC large break LOCA calculations in a UHI equipped PWR.** Guidotti, T.E. (Battelle Pacific Northwest Lab., Richland, WA). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The COBRA/TRAC computer program has been developed to predict the thermal-hydraulic response of nuclear reactor primary coolant systems to small and large break loss-of-coolant accidents and other anticipated transients. It was derived from the merging of COBRA-TF and TRAC-PD2. The COBRA/TRAC code has been compared with experimental data for the following phenomena: counter-current flow limiting, transient downcomer behavior, condensation, subcooled boiling, nucleate boiling, natural circulation, upper head drain behavior, reflood, critical heat flux film dryout, phase separation, and uncovery/recovery.

18554 (NUREG/CP—0041-Vol.2, pp 76-112) **Results of independent assessment.** Odar, F. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

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The independent assessment of NRC sponsored advanced best-estimate codes is being undertaken in four national laboratories. They are Los Alamos National Laboratory (LANL), Idaho National Engineering Laboratory (INEL), Brookhaven National Laboratory (BNL), and Sandia National Laboratory (SNL). The assessment is performed in three ways. The first is a quantitative assessment where the uncertainties in calculating selected key parameters are determined. The second is an assessment through separate effects and basic tests were the capabilities of the code to predict basic two phase flow phenomena are addressed. The third is a qualitative assessment where overall predictive capability of the code is assessed. The status of the assessments of the following codes are presented: TRAC-PD2, TRAC-PF1, RELAP5/MOD1, and TRAC-BD1.

18555 (NUREG/CP—0041-Vol.2, pp 185-203) **Experimental program in core melt aerosol release and transport.** Parker, G.W. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A survey of the requirements for an experimental demonstration of core-melt aerosol release has indicated that the most practical technique is that referred to as skull melting by rf induction. The implied skull would be a preformed ZrO_2 or ThO_2 shell composed of presintered powdered oxide. The advantages of this method include freedom from foreign container materials, a cold wall environment that ensures furnace integrity, and an almost unrestricted use of steam or other atmosphere as the cover gas. The major emphases of the project will be first to investigate chemical states and adsorption processes for simulant fission products, particularly iodine and cesium, and second, to measure the coagglomeration and total attenuation rate of all vaporized species with the structural material aerosols. The initial part of the effort has been dedicated to the development of a demonstration scale (1.0-kg), water-cooled, skull container with segmented copper components. A second part of the effort has been concerned with the design of a full 10- to 20-kg scale furnace and the selection of a 250-kW-rf power unit to match the furnace.

18556 (NUREG/CP—0041-Vol.2, pp 207-231) **Fission product release into the environment during a PWR core meltdown accident.** Hosemann, J.P. (Kernforschungszentrum, Karlsruhe, Germany). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A reactor pressure vessel contains not only radioactive substances, all of which will be released during a core meltdown accident, but besides water contains also various steel internal structures, control rods and, of course, fuel elements. This paper is a discussion of the fission products that could be expected to be released and transported during the meltdown of a pressurized water reactor.

18557 (NUREG/CP—0041-Vol.2, pp 232-244) **Recent improvements to the TRAP-MELT RCS fission product transport code.** Gieseke, J.A.; Kuhlman, M.R.; Freeman-Kelly, R.; Avers R.J.; Denning, R.S. (Battelle Columbus Labs., OH). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The TRAP-MELT code is intended to provide a method for predicting the transport and deposition of radionuclides within reactor structures along flow paths between the fuel and the containment barrier. The code is currently applicable under accident conditions estimated for core meltdown accidents although in a previous version of the code, terminated loss-of-coolant accident conditions were considered. The radionuclide materials are modeled as transporting in both vapor and particulate forms and depositing from the gas flow as they are transported. Emphasis has been placed on transport and deposition within the reactor coolant system but the mechanistic models on which the code is based are equally adaptable to consideration of alternate flow paths. The extension to numerous species, the improvement of the deposition models based on experimental data, and the improvement of physical descriptions of radionuclide species interactions comprise the major portion of current development efforts.

18558 (NUREG/CP—0041-Vol.2, pp 254-276) **Fuel element gap irregularities determined from infrared scanning.** Burman, D.L.; Davis, D.D.; Leech, W.J.; McCulloch, R.W. Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

It has been hypothesized that the fuel pellet column in a nuclear fuel rod will not be concentric in the cladding. The pellets will assume random offsets, and frequent contact with the tube, resulting in a series of broken spirals. Evidence for the existence and stability of spiralling pellet columns has been observed from crud patterns on fuel rods irradiated for one and two cycles in commercial reactors. Such behavior has important implications on the pellet to cladding thermal conductivity under both normal and accident conditions and on the swelling and burst of cladding under LOCA conditions. An experimental program to verify and quantify the pellet offset behavior in an unirradiated commercial fuel rod was undertaken at ORNL under the sponsorship of the Central Electricity Generating Board and Westinghouse Electric Co. The results of the experimental program were used to develop a model to predict the burst strain behavior of the NRU test rods and were compared with the empirical correlation of the gap conductance inferred from instrumented Halden rods. The tests were performed on a Westinghouse 17 x 17 fuel rod made to the same specifications as commercial fuel except that the fuel pellets were made from depleted UO_2.

18559 (NUREG/CP—0041-Vol.2, pp 355-363) **Status of the CONTAIN computer code for LWR containment analysis.** Bergeron, K.D.; Murata, K.K.; Rexroth, P.E.; Clauser, M.J.; Senglaub, M.E.; Sciacca, F.W.; Trebilcock, W. (Sandia National Labs., Albuquerque, NM). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2). Contract AC04-76DP00789.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The current status of the CONTAIN code for LWR safety analysis is reviewed. Three example calculations are discussed as illustrations of the code's capabilities: (1) a demonstration of the spray model in a realistic PWR problem, and a comparison with

CONTEMPT results; (2) a comparison of CONTAIN results for a major aerosol experiment against experimental results and predictions of the HAARM aerosol code; and (3) an LWR sample problem, involving a TMLB' sequence for the Zion reactor containment.

18560 (NUREG/CP—0041-Vol.2, pp 410-418) **Retrofitting nuclear plants for the mitigation of core melt effects.** Hammond, R.P.; Dooley, J.L. (R and D Associates, Marina del Rey, CA). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The feasibility of retrofitting a PWR with a caisson for the purpose of retaining molten core debris in the event of a Class 9 accident is discussed.

18561 (NUREG/CP—0041-Vol.2, pp 453-461) **Improvement of MARCH for BWR applications.** Greene, S.R. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The MARCH (Meltdown Accident Response CHaracteristics) code describes the response of light-water reactor and containment systems to core meltdown accidents. The original MARCH 1.0 version was officially released by Battelle Columbus Laboratories near the end of 1980. A second version of the code (MARCH 1.1) was released a few months later. Since MARCH was developed for early LWR probabilistic risk assessment (PRA) evaluations, the code's structure and modeling sophistication reflect the limited goals of such applications. Although MARCH 1.1 is a remarkably versatile and useful tool for many LWR accident analysis applications, its suitability for realistic BWR severe accident analysis is significantly compromised by its failure to consider many of the basic design and operating differences which distinguish BWRs from PWRs. The purpose of this paper is to briefly summarize these MARCH modeling deficiencies and describe efforts currently underway to improve the code's BWR simulation capabilities.

18562 (NUREG/CP—0041-Vol.2, pp 489-494) **Analysis in support of operator guidelines for severe accidents using TRAC-PWR.** DeMuth, N.S.; Dobranich, D.; Henninger, R.J. (Los Alamos National Lab., NM). Jan 1983. NTIS, PC A22/MF A01 - GPO $11.00. (CONF-821037—Vol.2).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Nuclear Regulatory Commission initiated the Severe Accident Sequence Analysis (SASA) program to further understand both of reactor accident phenomena and of the human-machine interface during a spectrum of accidents. Efforts as Los Alamos for the SASA program have focused on (1) identification of potential accidents involving multiple equipment failures, (2) computer simulations of postulated accident sequences including equipment malfunctions and operator actions and (3) evaluation of critical safety equipment and operator responses. Recent analyses at Los Alamos have used the Transient Reactor Analysis Code (TRAC), version PF1, to investigate the movement of hydrogen in pressurized water reactors following a small-break loss-of-coolant accident. Also, TRAC is being used to study severe accidents in Babcock and Wilcox (B and W) plants. The results of the hydrogen-movement investigations, along with the ongoing B and W severe accident analyses will be discussed.

18563 (NUREG/CP—0041-Vol.3) **Tenth water reactor safety research information meeting: proceedings. Volume 3.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1983. 308p. (CONF-821037—Vol.3). NTIS, PC A14/MF A01 - GPO $8.50. Order Number DE83901307.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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Separate abstracts were prepared for papers presented in the following areas: (1) Human Factors Research; (2) Instrumentation and Control Research; (3) Occupational Radiation Protection; and (4) Safety/Safeguards Interaction.

18564 (NUREG/CP—0041-Vol.3, pp 9-14) **Human factors research at the OECD Halden Reactor Project.** Jenkins, J.P. (Office of Nuclear Regulatory Research, Washington, DC). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This paper presents the major activities concerning application of process computers and human factors analysis of nuclear power plant control developed through the use of prototype software systems, display/control hardware and control room man-machine concepts at the Halden Reactor Project.

18565 (NUREG/CP—0041-Vol.3, pp 23-39) **Allocation of functions to man and machine in the automated control room.** Pulliam, R.; Price, H.E. (BioTechnology, Inc., Falls Church, VA). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A practical framework and set of methodologic tools are discussed which could be used by a design team in allocating nuclear power plant control functions to either man or machine control. It is concluded that allocations of functions must eventually become a formal step in control system design, i.e., it will become increasingly necessary to invest in human factors analysis as an integral part of the design process.

18566 (NUREG/CP—0041-Vol.3, pp 40-43) **Review of operational aids for nuclear plant operators.** Kisner, R.A. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Many approaches are being explored to improve the safety of nuclear plant operations. One approach is to supply high-quality, relevant information by means of computer-based diagnostic systems to assist plant operators in performing their operational and safety-related roles. The evaluation of operational aids to ensure safe plant operations is a necessary function of NRC. This work has two purposes: to collect limited data on a diversity of operational aids, and to provide a method for evaluating the safety implications of the functions of proposed operational aids. After a discussion of the method evaluation now under study, this paper outlines this data collection to date.

18567 (NUREG/CP—0041-Vol.3, pp 52-54) **Human error analysis program.** Luckas, W.J. Jr. (Brookhaven National Lab., Upton, NY). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objective of this program has been to develop and apply realistic human performance data and models to help evaluate the human's role in nuclear power plant safety. To meet this objective, the major FY 82 effort was placed in several areas of investigation and accomplishment, namely: the further development of Human Error Rates; the use of Performance Shaping Factors and quantified expert judgement in the evaluation of human reliability - the Success Likelihood Index Method. The development of the Operator Action Tree/Time Reliability Correlation approach for post human decision errors. The publishing of the Conference Record for the 1981 Workshop on Human Factors and Nuclear Safety.

18568 (NUREG/CP—0041-Vol.3, pp 63-67) **Emergency operating procedure validation methodology.** vonHerrmann, J.L. Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Plant Status Monitoring (PSM) Program was initiated by the Nuclear Regulatory Commission to develop and validate methods to systematically address a number of important safety

issues concerned with enhancing the operator's ability to respond to potential accident conditions. The basic thesis of the PSM program is that, while there are numerous facets of the overall man/machine interface problem, any efficacious changes to plant design and/or operation must be based on a firm foundation consisting of: an explicit identification of potential accident sequences and the plant states comprising these sequences; a careful delineation of the actions required of the operator at each plant state; and a clear understanding of the physical phenomenon associated with each plant state. In the first phase of the work reported here, the function- or symptom- oriented approaches which have evolved since the Three-Mile Island accident are summarized and discussed.

18569 (NUREG/CP—0041-Vol.3, pp 78-105) **Safety-related operator actions program.** Haas, P.M. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Safety-Related Operator Actions program is intended to provide information and data for use by NRC in assessing the performance of nuclear power plant control room operators in responding to abnormal/emergency events. The primary effort has involved collection and assessment of data from simulator experiments (actually recorded observations of training exercises) and from historical records of abnormal/emergency events that have occurred in operating plants (field data). These data are to be used to develop criteria for acceptability of the use of manual operator action for safety-related functions. The program also has included studies of training simulator capabilities, of procedures and data for specifying and verifying simulator performance, and of methods and applications of task analysis. The program is scheduled to be completed in FY 1983. This paper summarizes the major results of the program to date as well as the plans for completion of the program and the general plans for two related programs which have been initiated.

18570 (NUREG/CP—0041-Vol.3, pp 106-120) **NRC human factors research on nuclear industry organization and management: assumptions, objectives and milestones.** Ryan, T.G. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Nuclear Regulatory Commission (NRC) human factors research program described in the report focuses primarily on the functions and roles performed by nuclear industry management, within an organizational context, during power plant design, construction, start-up and operation. More specifically, this organization and management research program is a response to post Three Mile Island action and planning guidance including the NRC Action Plan (NUREG-0660), NRC Long Range Research Plan (NUREG-0740) and Human Factors Society Long Range Plan (NUREG/CR-2833).

18571 (NUREG/CP—0041-Vol.3, pp 121-125) **Management and organizational design: an initial look at a new project.** Osborn, R.N.; Olson, J. (Battelle Human Affairs Research Centers, Washington, DC). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This project is designed to establish one basis for empirically linking aspects of management and organizational design to the safe operation of nuclear power plants. Current work is focusing on (a) reviewing existing literature relevant to this linkage, and (b) isolating and incorporating numerous safety relevant indicators. Later stages of this project will involve hypothesis development, data collection and analysis.

18572 (NUREG/CP—0041-Vol.3, pp 133-136) **Past, present and future look at emergency preparedness.** Jamgochian, M.T. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

In June 1979, the Nuclear Regulatory Commission began a formal reconsideration of the role of emergency planning in ensuring the continued protection of the public health and safety in areas around nuclear power facilities. The commission began this reconsideration in recognition of the need for more effective emergency planning and in response to the TMI accident and to reports issued by responsible offices of government and the NRC's Congressional oversight committees. On December 19, 1979, the Nuclear Regulatory Commission published in the Federal Register proposed amendments to 10 CFR Part 50 and Appendix E to Part 50 of its regulations. The major changes from past practices are briefly discussed.

18573 (NUREG/CP—0041-Vol.3, pp 137-145) **PWR hybrid computer model for assessing the safety implications of control systems.** Smith, O.L.; Clapp, N.E.; Craddick, C.W.; Difilippo, F.C.; Morris, D.G.; Renier, J.P.; Weber, C.W. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The ORNL study of safety-related aspects of control systems consists of two interrelated tasks, (1) an augmented failure modes and effects analysis that will, in part, identify single and multiple component failures that may lead to significant plant upsets, and (2) a hybrid computer model that uses these failures as initial conditions and traces the dynamic impact on the control system and remainder of the plant. The second task is reported here.

18574 (NUREG/CP—0041-Vol.3, pp 146-157) **Augmented failure mode and effects analysis method for the assessment of the safety implications of control systems.** Stone, R.S. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Control systems have in the past been considered noncontributors to safety concerns. This having been demonstrated to be not the case by a number of events in operating plants, a program has been mounted to assess the safety impact of single and double failures in reactor control systems, using an augmented failure mode and effects analysis. The methodology is explained, and sample results of a broad study presented.

18575 (NUREG/CP—0041-Vol.3, pp 211-218) **Non-condensible gas fraction prediction using wet and dry bulb temperature measurements at elevated temperature and pressure.** Bowman, J.K. (Polaroid Corp., Cambridge, MA); Griffith, P. Jan 1983. NTIS, PC A22/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Using only wet and dry bulb temperature readings a method of calculating air (or nitrogen) and water vapor concentrations is developed. It is appropriate for high temperature and pressure. The method works in up or down flow and in stagnant mixtures. Experiments show that compositions can be predicted to +- 4%. Application to loss-of-coolant monitoring systems is discussed.

18576 (NUREG/CP—0041-Vol.3, pp 242-247) **Job skills analysis of nuclear power plant health physics technicians.** Meinhold, C.B.; Marotta, F.J. (Brookhaven National Lab., Upton, NY). Jan 1983. (P). NTIS, PC A22/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

In 1979 the NCRCP asked its Scientific Committee 46 on Operational Radiation Safety to develop a report on Training for the Radiation Worker. At an early stage in the preparation of this report, the Committee recognized the need to adopt a multi-step training process with its roots in job and task analysis. This precise approach to training evolved from the military's Instructional Systems Development and it has since been adapted by Analysis and

Technology, Inc., for power reactor operations for the Institute of Nuclear Power Operations.

18577 (NUREG/CP—0041-Vol.4) **Tenth water reactor safety research information meeting: proceedings. Volume 4.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1983. 322p. (CONF-821037—Vol.4). NTIS, PC A14/MF A01 - GPO $9.00. Order Number DE83901344.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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Separate abstracts were prepared for the papers presented on Materials Engineering.

18578 (NUREG/CP—0041-Vol.4, pp 9-22) **Work of the ICCGR on environmentally affected crack growth.** Cullen, W.H. (Materials Engineering Associates, Inc., Lanham, MD). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Recent research efforts in the field of environmentally assisted crack growth in light water reactor pressure vessel and piping steels are discussed. Coordination of the efforts of various laboratories has and will continue to shorten the time-to-solution of the research endeavors.

18579 (NUREG/CP—0041-Vol.4, pp 147-156) **Piping reliability model development, validation and its applications to light water reactor piping.** Woo, H.H. (Lawrence Livermore National Lab., CA). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A brief description is provided of a three-year effort undertaken by the Lawrence Livermore National Laboratory for the piping reliability project. The ultimate goal of this project is to provide guidance for nuclear piping design so that high-reliability piping systems can be built. Based on the results studied so far, it is concluded that the reliability approach can undoubtedly help in understanding not only how to assess and improve the safety of the piping systems but also how to design more reliable piping systems.

18580 (NUREG/CP—0041-Vol.4, pp 168-183) **Fracture toughness characterization of irradiated, low-upper shelf welds.** Loss, F.J.; Menke, B.H.; Hiser, A.L. (Materials Engineering Associates, Lanham, MD). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Previous studies have shown that A533-B submerged arc weld deposits of the type used in the beltline region of some commercial, light water reactor vessels can exhibit low Charpy-V (C/sub v/) upper shelf energy levels after irradiation, that is, energies which lie below 68J (50 ft-lb). In this event, Federal regulations (10 CFR Part 50) require, as one option, the performance of a fracture mechanics analysis that conservatively demonstrates the existence of adequate margins of safety for continued operation. In the upper shelf region the vessel is assumed to exhibit elastic-plastic behavior so that a linear elastic fracture mechanics approach would be inappropriate. In resolving this issue the NRC has suggested that under elastic-plastic conditions the vessel can be properly evaluated in terms of the tearing instability concept of Paris and others. Currently, this concept is being verified through intermediate vessel tests at Oak Ridge National Laboratory (ORNL) under the Heavy Section Steel Technology Program. A summary of the results from this program is presented here.

18581 (NUREG/CP—0041-Vol.5) **Tenth water reactor safety research information meeting: proceedings. Volume 5.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1983. 397p. (CONF-821037—Vol.5). NTIS MF A01 - GPO $9.50. Order Number DE83901301.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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Separate abstracts were prepared for the papers presented in the following areas of interest: (1) Mechanical/Structural Engineering; (2) Load Combinations; (3) Seismic Safety Margins; (4) Structural Engineering; (5) Electrical Equipment Qualifications; and (6) Process Control and Accident Mitigation.

18582 (NUREG/CP—0041-Vol.5, pp 19-31) **Stresses in the HDR containment steel shell under blowdown loading.** Jansky, J. (Technical University, Stuttgart, Germany); Doltsinis, Ch.; Katzenmeier, G. Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Since 1977 about 35 steam and water blowdowns in the steel containment shell have been performed as part of the HDR Safety Program. Some of these were conducted with an automatically-closing valve to simulate a break upstream of the valve. Approximately 10 tests simulated a break that could occur between the reactor pressure vessel (RPV) and an isolation valve, resulting in a total blowdown (unlimited in time) of the primary system. A break in the main steam line and a break in the feedwater line were simulated. The break size was varied during these tests, as well as the pipe lengths between the theoretical break location (rupture disk) and the RPV, the latter under nominal operating conditions (typically 80 bar and 280°C initial pressure and temperature). One of the many objectives of these tests was the behavior of the steel containment shell when subjected to an increase in inner pressure and to local as well as global temperature gradients while the coolant flowed from the simulated pipe break. All results show that the highest global stresses are induced in the steel structure within the first few minutes after the blowdown begins.

18583 (NUREG/CP—0041-Vol.5, pp 37-62) **Computer code verification: mechanical piping benchmark problems.** Bezler, P.; Subudhi, M.; Reich, M.; Wang, Y.K.; Shteyngart, S. (Brookhaven National Lab., Upton, NY). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The verification of computer codes through the development and use of both analytical and physical Piping Benchmark Problems has continued through FY'82. During this period the computer verification process has been expanded to the consideration of and comparison to actual piping tests results. Through a cooperative program with EPRI and their contractor ANCO, test results from earlier piping tests and scheduled piping tests are being made available for the verification purpose. Concurrent with these efforts a study has been initiated to determine the levels of conservatism associated with the inertial and psuedo static response inherent in multiple supported pipings systems subjected to distinct inputs and for establishing a revised position for the evaluation of these types of piping systems and their supports.

18584 (NUREG/CP—0041-Vol.5, pp 101-106) **Probability of pipe breaks in PWR primary system pipings.** Chou, C.K. (Lawrence Livermore National Lab., CA). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This paper describes the activity undertaken to assess the requirement of pipe whip restraints for all PWR nuclear power plant reactor coolant loop (RCL) systems. The technical bases developed in this assessment can also be used in making licensing decisions for the design requirements of asymmetric blowdown LOCA load and the combination of safe shutdown earthquake (SSE) earthquake load and the loads caused by the double-ended guillotine break of the RCL system.

18585 (NUREG/CP—0041-Vol.5, pp 107-130) **Probability based load combinations for design of category I structures.** Reich, M.; Hwang, H.; Shinozuka, M.; Ellingwood, B.; Wang, P.C. (Brookhaven National Lab., Upton, NY). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objective of this program is to develop a rational approach, based on probabilistic considerations, for the safety evaluation of reactor containment and other seismic category I structures subjected to multiple static and dynamic loadings. Furthermore, based on the above developed probabilistic approach, a load combination methodology for design of seismic category I structures will be established. Under this program, a reliability analysis method for seismic category I structures has been developed. The method which incorporates the finite element method and the theory of random vibration, enables the evaluation of the limit state probabilities for structures under various static and dynamic loads. Furthermore, work on load combinations for the design of concrete containment structures based on the previously developed method is underway.

18586 (NUREG/CP—0041-Vol.5, pp 131-185) **Seismic Safety Margins Research Program.** Bohn, M.P.; Wells, J.E.; Shieh, L.C.; Johnson, J.J. (Lawrence Livermore National Lab., CA). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Program goals were established to be achieved in two phases. Goals for Phase I were: (1) develop earthquake and fragility data bases; (2) develop risk computation methodology; and (3) perform limited demonstration calculations. Phase I was completed in February, 1981. Goals for Phase II are: (1) complete Zion reactor seismic risk analysis; (2) develop a simplified methodology for a PWR; (3) extend simplified methodology for a BWR; (4) perform verification of tools and models; and (5) make methodology available to outside users. Results to date are presented in summary form. The final report schedule is February, 1983.

18587 (NUREG/CP—0041-Vol.5, pp 186-190) **Containment integrity program.** Blejwas, T.E. (Sandia National Labs., Albuquerque, NM). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objective of the Containment Integrity Program is the qualification of methods for predicting the ultimate capacity of LWR containments under severe accidents and environmental conditions. To attempt to achieve this objective, a combination of experimental and analytical efforts are underway. The experiments consist of tests of models of complete containment structures and, where necessary, tests of separate containment components. By comparing the data from the experiments with analytical results, the adequacy of analytical methods can be assessed. Although a background study addressed a variety of loading conditions, only quasi-static internal pressurization is included in the present experimental/analytical efforts.

18588 (NUREG/CP—0041-Vol.5, pp 191-204) **Steel containment buckling.** Bennett, J.G. (Los Alamos National Lab., NM). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objective of the Steel Containment Buckling Program at Los Alamos is to provide the Nuclear Regulatory Commmission (NRC) with a basis for evaluating steel containment designs for the licensing issues that are associatd with structural instability (buckling). The large shell displacements that can occur because of buckling have potential for violating the containment function by destroying or warping seals around penetrations, causing puncture or tearing of the shell wall from nearby or attached hard points, and initiating fractures at welds or in heat affected zones. Recommendations for changes in, and additions to the NRC review criteria are a natural outgrowth of the program. Areas of experimental and analytical study are identified.

18589 (NUREG/CP—0041-Vol.5, pp 205-217) **Category I structures safety margins.** Endebrock, E.G. (Los Alamos National Lab., NM). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This program was established to address the licensing issue: Can existing facilities continue to operate in light of more demanding criteria than considered in the initial design. Some results on dynamic tests of small isolated shear wall structures are presented. The shear wall structures were subjected to sine-sweeps and to an earthquake accelerogram. The primary conclusion was that sine-sweep tests are not useful for nonlinear behavior studies.

18590 (NUREG/CP—0041-Vol.5, pp 218-226) **Summary of research on containment elements.** White, R.N.; Gergely, P. (Cornell Univ., Ithaca, NY). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This paper summarizes recent developments in the strength and stiffness of reinforced concrete plate-type elements subjected to combined in-plane tension and either in-plane membrane shear or punching (peripheral) shear. Applications of results are made to suggested design criteria for reinforced concrete containments carrying load combinations that lead to stress conditions similar to those defined above. These design criteria are crucial for evaluation of existing containment structures under newly defined loadings, and for improved design of new containments.

18591 (NUREG/CP—0041-Vol.5, pp 227-255) **Engineering characterization of ground motion for nuclear power plant design.** Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objective of this research study is to develop recommendations for methods for selecting design response spectra or time histories to be used to characterize earthquake ground motions at the foundation level of nuclear power plants. This objective will be accomplished by two tasks. In Task I, recommendations will be developed for methods for choosing translational response spectra taking into account nonlinear structural behavior. In Task II, the results of Task I will be integrated with further studies incorporating wave passage and soil-structure interaction effects to develop recommendations for choosing foundation-level design response spectra and input motions for translational and rotational motions. Task I has been essentially completed and Task II is being performed. This report provides a brief description of the summary and conclusions of Task I and the work plan for Task II.

18592 (NUREG/CP—0041-Vol.5, pp 256-274) **Evaluation of dynamic testing of nuclear power plant structures.** Kot, C.A.; Srinivasan, M.G.; Hsieh, B.J. (Argonne National Lab., IL). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The original objective of this program was to establish a rational basis for the possible inclusion of dynamic testing of as-built nuclear power plant (NPP) structures in the licensing process. This objective was to be achieved through evaluations of dynamic testing techniques, and associated data analyses methods, and through an investigation on the validity of predictive analytical models by making comparisons of dynamic response measured in tests on as-built structures with that given by predictive analytical models. The evaluative part would involve a survey and critical review of published and other information on dynamic testing of as-built structures. The comparison studies were to be based on the data to be obtained from the series of dynamic tests performed on the Heissdampfreaktor (HDR) containment building in the Federal Republic of Germany. Acquisition of the HDR data was to be a part of close participation in the ongoing HDR test program. The cur-

rent opinion of NRC management is that dynamic testing of existing or as-built nuclear power plant structures is unlikely. Therefore in April 1982 the objective and scope of this program were curtailed to the evaluation of feasibility and the establishment of the value of dynamic testing of as-built nuclear power plant structures. The investigative aspects and the evaluative studies of the program will be completed in an orderly fashion without making any recommendations as to the possibility of including dynamic testing of nuclear power plant structures in the licensing process.

18593 (NUREG/CP—0041-Vol.5, pp 275-280) **Electrical equipment qualification.** Farmer, W.S. Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Electrical equipment qualification research programs being carried out by CEA, JAERI, and Sandia Laboratories are discussed. Objectives of the program are: (1) assessment of accident simulation methods for electrical equipment qualification testing; lower coarse (2) evaluation of equipment aging and accelerated aging methods; (3) determine radiation dose spectrum to electrical equipment and assess simulation methods for qualification; (4) identify inadequacies in electrical equipment qualification procedures and standards and potential failure modes; and (5) provide data for verifying and improving standards, rules and regulatory guides.

18594 (NUREG/CP—0041-Vol.5, pp 305-317) **Equipment qualification testing methodology research at Sandia Laboratories.** Jeppesen, D. (Sandia National Labs., Albuquerque, NM). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Equipment Qualification Research Testing (EQRT) program is an evolutionary outgrowth of the Qualification Testing Evaluation (QTE) program at Sandia. The primary emphasis of the program has been qualification methodology research. The EQRT program offers to the industry a research-oriented perspective on qualification-related component performance, as well as refinements to component testing standards which are based upon actual component testing research.

18595 (NUREG/CP—0041-Vol.5, pp 318-329) **Nuclear qualification results obtained at the CEA and NRC-CEA cooperative research program.** Chenion, J.; Berthet, J.; Gaussens, G.; Le Meur, M. Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Since 1977, several studies have been done on polymeric materials with the Commissariat a l'Energie Atomique (CEA). These studies have been done for determining the accelerated testing conditions which allow to evaluate the time of life of thes materials which have been subject to an aging. In fact, during the life of a plant, these materials are put under a light dose rate, for a large period, at a higher temperature than the ambient temperature and are under aging due to a radio-accelerated oxidation process. If such a process must be reproduced in a short time, by putting samples under a high dose rate irradiation, the dissolved oxygen is consumed faster than it can be renewed by diffusion. Studies were undertaken to fix the accelerated limit conditions of simulation tests.

18596 (NUREG/CP—0041-Vol.5, pp 330-360) **Methodology study for qualification testing of wire and cable at LOCA conditions.** Kusama, Y.; Okada, S.; Yoshikawa, M.; Ito, M.; Yagi, T.; Nakase, Y.; Seguchi, T.; Yoshida, K. (Japan Atomic Energy Research Inst., Takasaki). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Concerning development of the qualification testing of wire and cable for use in nuclear power generating stations, many factors which influence the deterioration of cable materials in LOCA environment were examined. Among the problems associated with LOCA environmental testing, synergism between radiation and LOCA steam spray environment was studied, first by comparing the deterioration by simultaneous, sequential and reverse sequential exposure of both environments with or without air. Effects of exposure time in LOCA simulation, and of heating or cooling rate in transient part, differ with the type of materials. However, those factors do not have definitive influence on the deterioration of the materials, especially in saturated steam environment. On the other hand, oxygen in LOCA radiation and steam spray environment accelerates degradation of both mechanical and electrical properties of most insulating materials except silicone rubber. Synergism of heat and radiation is observed under LOCA conditions containing oxygen.

18597 (NUREG/CP—0041-Vol.5, pp 386-390) **PRTR accident: a preliminary report on the investigation of fission product chemical forms.** Hensley, W.K.; Rogers, L.A. (Pacific Northwest Lab., Richland, WA). Jan 1983. NTIS MF A01 - GPO $9.50. (CONF-821037—Vol.5).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The recent accident at Three Mile Island (TMI) has sparked an interest in previous reactor incidents for which data were available which might offer insights into the radiological release characterization resulting from an accident of this nature. The Plutonium Recycle Test Reactor (PRTR) located at Richland, Washington, has been identified as a reactor which has undergone one such incident. At the request of the Nuclear Regulatory Commission, the Pacific Northwest Laboratory (PNL) is reviewing the PRTR incident to assemble and update all the information available regarding the volatile and semi-volatile fission products released to discover and investigate any clues that remain which may indicate the most probable chemical and physical forms of these released fission products.

18598 (NUREG/CP—0041-Vol.6) **Tenth water reactor safety research information meeting: proceedings. Volume 6.** Szawlewicz, S.A. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jan 1983. 278p. (CONF-821037—Vol.6). NTIS, PC A13/MF A01 - GPO $8.00. Order Number DE83901305.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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Separate abstracts were prepared for the papers presented in the following areas: (1) Risk Analysis; and (2) EPRI Safety Research Program.

18599 (NUREG/CP—0041-Vol.6, pp 1-8) **Overview of PRA.** Bernero, R.M. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The generation and publication of the Reactor Safety Study (WASH-1400) was the major event which marks the start of the use of probabilistic risk analysis (PRA) for nuclear reactors in the US. The strengths and weaknesses of the study are discussed, as is the revitalization of PRA as a decision making tool.

18600 (NUREG/CP—0041-Vol.6, pp 9-11) **Progress in risk methodology programs.** Johnson, J.W.; Niyogi, P.K. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Nuclear Regulatory Commission has made considerable progress in methodology and data development applicable to Probabilistic Risk Assessment. The primary focus of the research has been in the following distinct areas: (1) data base development; (2) statistical and uncertainty evaluations; (3) common cause analysis; (4) system unavailability modeling; (5) analysis of limiting conditions for operations; and (6) loss of benefits from plant shutdown.

18601 (NUREG/CP—0041-Vol.6, pp 12-21) **Status of common cause screening and in-plant flooding programs.** Wagner, D.P.; Casada, M.L.; Flanagan, G.F. Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This report presents the status of the Common Cause Screening and Flood Risk programs that JBF Associates, Inc. is carrying out for the Oak Ridge National Laboratory and the Nuclear Regulatory Commission, Division of Risk Analysis. Efforts over the last three years have resulted in methodology and computer aids for efficient common cause failure analysis for use in nuclear power plant probabilistic risk assessments. Current efforts are incorporating these techniques into the draft National Reliability Evaluation Program Procedures Guide (NUREG/CR-2815). This presentation discusses the objectives and results of past work; objectives, status and expected results of current efforts; and future efforts needed to complete or supplement the methodology to provide a practical tool for common cause failure analysis.

18602 (NUREG/CP—0041-Vol.6, pp 22-31) **In-plant reliability data system.** Borkowski, R.J. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6). Contract W-7405-ENG-26.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objectives of the In-Plant Reliability Data (IPRD) program are threefold: (1) to develop an equipment failure data base for Probabilistic Risk Analysis (PRA) use; (2) to identify the generic problems within the industry as to what components exhibit the same type of failures throughout the industry, and what could be done to help improve the reliability of these components, realizing the types of failures that occur; and (3) to identify the failure trends in a plant or a specific component. The major elements of the IPRD program are threefold: the data collection, the data base preparation, and the data analysis.

18603 (NUREG/CP—0041-Vol.6, pp 32-43) **Methodological issues in the study of risk perception and human behavior.** Rathbun, P.F. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The purpose of this paper is to provide a broad perspective on the use of the methods and techniques of the behavioral and social sciences as they pertain to the work of the Nuclear Regulatory Commission, particularly in issues of risk perception. Four major topics or themes are discussed: (1) a brief overview of the classic theories of risk perception; (2) current contractor work in the area of risk perception and cognitive psychology; (3) other uses of the social and behavioral sciences in the Agency; and (4) methodological considerations in using the techniques.

18604 (NUREG/CP—0041-Vol.6, pp 44-55) **Progress in reactor risk programs.** Burdick, G.R. (Nuclear Regulatory Commission, Washington, DC). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Progress in reactor risk programs in the NRC Division of Risk Analysis during FY-1982 is described in a framework of four major objectives covering development of methods for: risk assessment, risk reduction, maintenance of plant safety level, and improved operational capabilities. Future efforts will be structured, coordinated and prioritized by the Analytical Hierarchy Process.

18605 (NUREG/CP—0041-Vol.6, pp 68-76) **Integrated assessment of pressurized thermal shock.** Kryter, R.C. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6). Contract W-7405-ENG-26.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The objectives of this research program are to: (1) develop appropriate methodologies for assessing the likelihood of reactor pressure vessel failure as a result of sudden, inadvertent vessel overcooling in combination with high internal pressure (this combination of circumstances has been termed pressurized thermal shock (PTS)); and (2) apply the resulting methodologies to three representative PWRs so as to obtain a balanced assessment, independent of similar studies performed by the NRC staff and industry owners' groups, of the total probability of vessel failure posed by a combination of all conceivable pathways leading to PTS in the plants selected for study.

18606 (NUREG/CP—0041-Vol.6, pp 85-94) **MELCOR program.** Aldrich, D.C.; Denning, R.S. Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The MELCOR code is being written to perform consequence calculations in probabilistic risk assessments. To the extent possible, consistent with the required level of accuracy, the code will use simple, fast-running models. Particular emphasis is being placed in the writing of MELCOR on the development of a modular structure that will be able to accept improved routines as they are developed in the future. In the short term, improvements are being made in the MARCH and MATADOR codes to satisfy the need for consequence analysis prior to the availability of MELCOR.

18607 (NUREG/CP—0041-Vol.6, pp 105-114) **PRA has many faces - can the safety goal be well-posed.** Bargmann, H. (Swiss Federal Inst. for Reactor Research, Wuerenlingen). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The question is discussed whether probabilistic reliability problems can, principally, be well-posed in practical situations. The problem is reduced to the question whether an underlying probabilistic experiment which is, essentially, the set of outcomes can be precisely specified such that the solution of the problem is unique. Upon reexamination of a classical paradox due to Bertrand and consideration of a typical problem of structural reliability we conclude that the possibility of well-posing a reliability problem should be considered illusory, for fundamental reasons which are inherent in practical situations. In particular, it should not be assumed that a quantitative safety goal could be verified. Generally, a probabilistic assessment should be considered as a quantitative method for establishing rational results which should, however, not be viewed as quantitative measures but as qualitative guides.

18608 (NUREG/CP—0041-Vol.6, pp 115-177) **Light water reactor (LWR) safety research at EPRI: an update.** Loewenstein, W.B.; Kalra, S.P. (Electric Power Research Inst., Palo Alto, CA). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The overall philosophy of the Electric Power Research Institute's (EPRI) LWR Safety Research Program is to quantify assurance of safety and reliability of nuclear power plants. This requires knowledge and understanding of phenomena associated with the dominant scenarios. Such insight will support the prevention or minimization of the consequences of postulated scenarios. Therefore, the research has been performed in many areas. Typically, improving the understanding of system behavior during normal or off-normal transients is the result. This requires understanding the behavior of fuel, materials, plant components, and structures under such scenarios. Experimental data and analyses for safety evaluations are the fruits of the research. These can lead to upgrading the safety aspects of the engineering and operational characteristics of the nuclear power plants and provide insight or the technical assessments of the advanced concepts for improved safety and reliability. The LWR safety research efforts are specifically oriented toward addressing more closely identified safety issues and concerns, and for providing the validated analytical tools for an adequate understanding and prediction of the behavior of the reactor systems and components.

18609 (NUREG/CP—0041-Vol.6, pp 178-191) **EPRI research on hydrogen combustion and control.** Thompson, L. (Electric Power Research Inst., Palo Alto, CA). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

EPRI is conducting a program to study hydrogen combustion behavior in the LWR containment building environments that could follow severe postulated nuclear accidents. Flammability limits, deflagrations, combustion control methods, equipment survivability, and hydrogen mixing and distribution in hydrogen, air, steam, and water spray environments have been investigated in several projects. Analytic models and computer codes are also being developed and evaluated for combustion behavior and for hydrogen mixing and distribution processes.

18610 (NUREG/CP—0041-Vol.6, pp 192-210) **EPRI equipment qualification research program.** Sliter, G.E. (Electric Power Research Inst., Palo Alto, CA). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

This paper contains brief descriptions of five research efforts included in EPRI's electrical equipment qualification program: (1) a review of aging theory and technology, which pointed out the severe limitations of the Arrhenius method in quantifying qualified life, at the same time that it provided a compendium of aging data useful in applying the method; (2) the Equipment Qualification Data Bank, which can be used in its existing and future expanded versions to reduce costly duplication of efforts by disseminating qualification information among industry users; (3) radiation effects studies, in which data are being compiled on threshold doses for radiation damage to materials; the data can be referenced to exempt equipment in relatively benign plant areas from plant-specific radiation testing or to select the best materials for performance in severe radiation environments; (4) an aging/seismic correlation program, which is providing test data showing that, in many cases, the effects of age degradation on the performance of electrical components under seismic excitation are negligibly small; and (5) hydrogen burn survivability tests, which so far have shown that equipment designed and qualified for severe loss-of-coolant accident environments with the conservative techniques in practice today can survive short-duration traumas from hydrogen burns during degraded-core accidents.

18611 (NUREG/CP—0041-Vol.6, pp 211-254) **DASS SPDS: a technical brief.** Cain, D.; Long, A.; O'Brien, J. (Electric Power Research Inst., Palo Alto, CA). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The EPRI/DASS program is concerned with the development of advanced computerized operator aids for both safety and non-safety applications. The recent focus in DASS has shifted to the logical extensions to Safety Parameter Display Systems (SPDS) which: make better use of the larger data set being provided in most Emergency Response Facility data systems; provide enhanced operator support; are based on highly flexible application software. The long-term objective of the program is to develop better means for handling operator cognition and problem-solving tasks in the control room. In this context computerized aids will be configured to (1) compensate for human engineering deficiencies in the control room which would otherwise require major refurbishments; and (2) eliminate the need for an on-shift technical advisor.

18612 (NUREG/CP—0041-Vol.6, pp 255-272) **Report on the EPRI pressurized thermal shock program.** Marston, T.U.; Sun, B.K.H.; Chexal, B.; Griesbach, T.J. (Electric Power Research Inst., Palo Alto, CA). Jan 1983. NTIS, PC A13/MF A01 - GPO $8.00. (CONF-821037—Vol.6).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The long-term potential for neutron embrittlement of reactor vessels as been a recognized concern for a number of years. Recently, significant attention has been focused on the performance of certain vessels during overcooling transients. The Electric Power Research Institute (EPRI) has been supporting research on reactor vessel integrity for a number of years. This work in the past focused mainly on materials and dosimetry. In June 1981, thermal hydraulics research also was expanded and accelerated. In addition, a cooperative program with four utilities was initiated to evaluate reactor vessel thermal shock for four specific plants including one from each PWR vendor. The pressurized thermal shock issue is being addressed at EPRI using matrix management to coordinate and apply the program results. In its program, EPRI is: (1) developing the capability to accurately predict reactor vessel wall transient temperatures; (2) developing the capability to accurately determine vessel wall radiation exposure; (3) developing the capability to accurately determine reactor vessel toughness; (4) developing a linked set of analytical codes to that utilities or their contractors can independently assess the effects of reactor vessel thermal shock with high accuracy; and (5) investigating ways to extend a reactor vessel's life.

18613 (NUREG/CR—2015-Vol.8-Rev.1) **Phase I final report: systems analysis (Project VII). Seismic Safety Margins Research Program. Vol. 8, Rev. 1.** Wells, J.E.; George, L.L.; Cummings, G.E. (Lawrence Livermore National Lab., CA (USA)). Nov 1983. Contract W-7405-ENG-48. 186p. (UCRL—53201-Vol.8-Rev.1). NTIS, PC A09/MF A01; 1 - GPO; GPO Dep. Order Number DE84007875.

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This document reports on the Phase 1 efforts of the Systems Analysis Project to develop the tools and methods for computing the probability of radioactive release from a commercial nuclear power plant in the event of an earthquake.

18614 (NUREG/CR—2679-Vol.3) **Advanced reactor safety research. Quarterly report, July-September 1982. Volume 23.** (Sandia National Labs., Albuquerque, NM (USA)). Jan 1984. Contract W-7405-ENG-26. 242p. (SAND—82-0904-Vol.3). NTIS, PC A11/MF A01 - GPO; GPO Dep. Order Number DE84008240.

Information is presented concerning core debris behavior; high-temperature fission-product chemistry and transport; containment analysis; elevated temperature materials assessment; development of LMFBR regulatory criteria and source terms; advanced reactor core phenomenology; LWR damaged fuel phenomenology; and ACRR status.

18615 (NUREG/CR—3309) **Simulator-based study of human errors in nuclear power plant control room tasks.** Beare, A.N.; Dorris, R.E.; Bovell, C.R.; Crowe, D.S.; Kozinsky, E.J. (General Physics Corp., Chattanooga, TN (USA)). Jan 1984. Contract AC04-76DP00789. 191p. (SAND—83-7095). NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84008232.

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The purposes of this study were to empirically establish error rates for control selection and operation during the performance of proceduralized tasks in nuclear power plant control rooms during simulated casualties, and to compare the observed error rates with the human error probabilities (HEPs) presented in NUREG/CR-1278. Data were collected at full-scale, high-fidelity simulators from licensed operators undergoing requalification training and students in the final stages of training prior to licensing. The data were collected using a Performance Measurement System (PMS), which records control manipulations and plant parameters. The basic HEPs in NUREG/CR-1278 were adjusted for the effects of selected performance shaping factors, such as stress and the improper use of procedures, as outlined in that document. The error rates obtained in this study were then compared with the adjusted HEPs, and were found to be largely in agreement.

18616 (NUREG/CR—3329-Vol.3) **Thermal/Hydraulic Analysis Research Program. Quarterly report, July-September 1983.** (Sandia National Labs., Albuquerque, NM (USA)). Dec 1983. Contract AC04-76DP00789. 83p. (SAND—83-1171-Vol.3). NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. Order Number DE84008278.

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The RELAP5 independent assessment project at Sandia National Laboratories is part of a multi-faceted effort sponsored by the NRC to determine the ability of various system codes to predict the detailed thermal/hydraulic response of LWRs during accident and off-normal conditions. The version used for the FY82 assessment project was RELAP5/MOD/CYCLE14, the latest publicly released version available at the time this project was begun. Updates have been received to create cycles 18 and 19. Cycle 18 with some additional recommended updates (most of which were later released as part of cycle 19) was used in FY82 only to determine if problems found with cycle 14 had already been found and corrected by INEL, and is being used as the MOD1 assessment code for calculations started in FY83. The FY83 project will complete the MOD1 assessment calculations.

18617 **(NUREG/CR—3412) Containment Integrity Program. Quarterly report, January-March 1983.** Blejwas, T.E.; Horschel, D.S.; Jung, J.; Reese, R.T. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1984. Contract AC04-76DP00789. 41p. (SAND—83-1482). NTIS, PC A02/MF A01; 1 - GPO; GPO Dep. Order Number DE84007407.

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This report contains a description of work performed in the second quarter of FY83 on the Containment Integrity Program. Plans for future work are presented. The overall objective of the program is the qualification of methods for reliably predicting the capability of containment structures to function under loadings caused by severe accidents and extreme environments. Both analytical and experimental efforts are underway. The experiments are tests of entire containment structures at reduced scale. Comparisons with test data provide a basis for qualifying the analytical methods.

18618 **(NUREG/CR—3422-Vol.2) Aerosol release and transport program. Quarterly progress report for April-June 1983. Volume 2.** Adams, R.E.; Tobias, M.L. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 49p. (ORNL/TM—8849/V2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007676.

This report summarizes progress for the Aerosol Release and Transport Program sponsored by the Nuclear Regulatory Commission's Office of Nuclear Regulatory Research, Division of Accident Evaluation, for April to June 1983. Topics discussed include (1) several capacitor discharge vaporization experiments in the CRI-III and Fuel Aerosol Simulant Test Facilities; (2) descriptions of dry atmosphere test 511 and steam atmosphere test 505 with iron oxide aerosols in the NSPP Facility; (3) technical support work for the aerosol test program at Marviken, Sweden; (4) US-German exchange experiment proposals concerning aerosols containing simulant fission products; (5) a core-melt test to observe metal-interaction effects in cladding degradation; (6) progress in construction of a 10-kg core-melt induction furnace; (7) analytical work in support of the FAST/CRI-III experiments; (8) aerosol code implementation; (9) NAUA code validation studies; and (10) steam-only experiments in the NSPP.

18619 **(NUREG/CR—3484) TRAN B-1: experimental investigation of fuel crust stability on surfaces of an annular flow channel.** McArthur, D.A.; Mast, P.K. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1984. Contract AC04-76DP00789. 57p. (SAND—83-1916). NTIS, PC A04/MF A01 - GPO; GPO Dep. Order Number DE84007026.

The TRAN B-Series experiments are being conducted at Sandia National Laboratories to investigate the characteristics of fuel removal/freezing through the upper axial blankets of a liquid-metal fast-breeder reactor during the transition phase of a hypothetical core-disruptive accident. The first experiment in this series, TRAN B-1, was performed in February 1983 and the results are reported herein. This experiment involved the injection of molten UO_2 into an annular flow channel. Previous experiments had shown crusts to be stable on the inside of a cylindrical flow channel. This experiment was intended to investigate whether the conclusion of crust stability could be extended to freezing on the outside of cylindrical rods (the more prototypic geometry of the upper axial blankets). The results of the TRAN B-1 experiment, consisting of data from online instrumentation and postirradiation examination, indicate that the crusts on both inner and outer surfaces of the annular channel were stable during the duration of the fuel flow.

18620 **(NUREG/CR—3529) Review of the Arkansas Nuclear One Generating Station Unit No. 1. Emergency feedwater system reliability analysis.** Youngblood, R.; Papazoglou, I.A. (Brookhaven National Lab., Upton, NY (USA)). Feb 1984. Contract AC02-76CH00016. 99p. (BNL-NUREG—51721). NTIS, PC A05/MF A01; 1 - GPO $4.75; GPO Dep. Order Number DE84008317.

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The purposes of this report are: (1) to review the Emergency Feedwater System Upgrade Reliability Analysis for the Arkansas Nuclear One Nuclear Generating Station Unit No. 1, and (2) to estimate the probability that the Emergency Feedwater System will not perform its mission for each of three different initiators: (1) loss of main feedwater with offsite power available, (2) loss of offsite power, (3) loss of all 4160 VAC power. The scope, methodology, and failure data are prescribed by NUREG-0611, Appendix III.

18621 **(NUREG/CR—3558) Handbook of nuclear power plant seismic fragilities, Seismic Safety Margins Research Program.** Cover, L.E.; Bohn, M.P.; Campbell, R.D.; Wesley, D.A. (Lawrence Livermore National Lab., CA (USA)). Dec 1983. Contract W-7405-ENG-48. 309p. (UCRL—53455). NTIS, PC A14/MF A01; 1 - GPO; GPO Dep. Order Number DE84007790.

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The Seismic Safety Margins Research Program (SSMRP) has a gola to develop a complete fully coupled analysis procedure (including methods and computer codes) for estimating the risk of an earthquake-induced radioactive release from a commercial nuclear power plant. As part of this program, calculations of the seismic risk from a typical commercial nuclear reactor were made. These calculations required a knowledge of the probability of failure (fragility) of safety-related components in the reactor system which actively participate in the hypothesized accident scenarios. This report describes the development of the required fragility relations and the data sources and data reduction techniques upon which they are based. Both building and component fragilities are covered. The building fragilities are for the Zion Unit 1 reactor which was the specific plant used for development of methodology in the program. Some of the component fragilities are site-specific also, but most would be usable for other sites as well.

18622 **(NUREG/CR—3649) Dynamic testing of as-built civil engineering structures: a review and evaluation.** Srinivasan, M.G.; Kot, C.A.; Hsieh, B.J. (Argonne National Lab., IL (USA)). Jan 1984. Contract W-31-109-ENG-38. 118p. (ANL—83-20). NTIS, PC A06/MF A01 - GPO; GPO Dep. Order Number DE84006494.

As part of an investigation on the role of dynamic testing for assessing the safety of as-built nuclear power plant structures, the experience with dynamic testing of other as-built large civil engineering structures is evaluated. A critical review of published literature on the dynamic testing of a large number of structures formed the basis for this evaluation. In addition studies on the use of recorded seismic response data from civil engineering structures for characterizing the dynamic behavior of the structures were also reviewed to establish the connection between test response and earthquake response. The different sources of excitation, and the associated methods of post-test data analysis for determining dynamic parameters from measured response are evaluated separately and by mutual comparison.

18623 **(ORNL/TM—9076) Dealing with uncertainty arising out of probabilistic risk assessment.** Solomon, K.A.; Kastenberg, W.E.; Nelson, P.F. (RAND Corp., Santa Monica, CA (USA); Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009119.

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In addressing the area of safety goal implementation, the question of uncertainty arises. This report suggests that the Nuclear Regulatory Commission (NRC) should examine how other regula-

tory organizations have addressed the issue. Several examples are given from the chemical industry, and comparisons are made to nuclear power risks. Recommendations are made as to various considerations that the NRC should require in probabilistic risk assessments in order to properly treat uncertainties in the implementation of the safety goal policy. 40 references, 7 figures, 5 tables.

18624 **(PTB-W—21) Explosiveness of mist/steam/air or mist/gas/air mixtures.** Foerster, H.; Steen, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Waerme). Apr 1983. 72p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750858.

The accidental release of a pressurized gas or liquid not only may lead to an explosive gas- or vapour-cloud, but even more may form a mist/gas/air-cloud (hybrid mixture cloud) and so risk analysis is faced with the question, if such hybrid mixtures may give rise to higher flame speeds and consequently higher explosion pressurizes and more severe damages than gas- or vapour-clouds of comparable turbulence and fuel concentration. This question is dealt with by measuring the flame velocities of test mixtures (octanol mist, propan gas and air) in a 1,7 m^3 vessel; the turbulence, the concentration of gaseous and liquid fuel and the mean drop size of the liquid phase are investigated as influencing parameters. Concerning the generation of the mist component the results indicate, that explosive mist/air-mixtures of moderate (e.g. atmospheric) turbulence are instable with respect to droplet-coagulation and so - due to the rapid sedimentation of large coagulated droplets - the spreading of explosive mist-air-mixtures under atmospheric turbulence will be rather limited.

18625 **(SAND—84-0067C) Economic risks of reactor outages and accidents.** Burke, R.P.; Aldrich, D.C.; Rasmussen, N.C. (Sandia National Labs., Albuquerque, NM (USA); Massachusetts Inst. of Tech., Cambridge (USA)). 29 Feb 1984. Contract AC04-76DP00789. 20p. (CONF-840427—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007245.

From Topical meeting on financial and economic bases for nuclear power; Washington, DC, USA (8 Apr 1984).

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Models were developed for analyses of economic risks from unanticipated events which occur, or could occur, during US LWR plant operation. The models estimate the economic consequences of LWR forced outages and accidents and can be used together with estimates of event frequencies to calculate the expected losses from LWR operational incidents of various severities. Both onsite costs, which either occur at onsite locations or most directly affect the plant licensee, and offsite costs, which most directly affect the public surrounding the plant, are estimated in the models. The models have been used in an example analysis to estimate the expected losses from both routine forced outage events and severe accidents during the remaining lifetime of the Surry No. 2 plant. The results of the analysis are used to draw important conclusions for LWR plant licensees and regulators regarding the operation of LWR plants in the US. In contrast to public health risks, economic risks from US LWR operation are dominated by high frequency, small consequence forced outage events. The economic risks from LWR operation are dominated by onsite losses resulting from replacement power costs for short-term outages.

18626 **(SDK-Ber—3304) Structure dynamics. Determination of the coupled relationships in solid-fluid-gas dynamics.** Hofmann, H.; Huber, A.; Naehring, T.; Bonakdarzadeh, S.; Faass, E.; Gaschen, J.P.; Kniffka, K.; Pilz, H. (SDK Ingenieurunternehmen fuer Spezielle Statik, Dynamik und Konstruktion, Loerrach (Germany, F.R.)). Jun 1980. 179p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84750875.

In the present paper the code concept SAN (Structure ANalysis) is presented. SAN is designed according to the modular principle using describing and coordinating modules. SAN is based on the discreetizing method. It uses compatible forms of description. The method of finite elements is applied. Solid-fluid-gas structures may be described as well as their interrelations in the linear and nonlinear region, including phase transitions with the associated descriptions of material and state.

18627 **Fission product transport in a BWR small-break LOCA.** Weber, C.F.; Hodge, S.A.; Lorenz, R.A.; Wichner, R.P.; Wright, A.L. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **45**: 479(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18628 **Iodine volatility under LWR accident conditions.** Beahm, E.C.; Shockley, W.E. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **45**: 482-483(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 18752

2502 Compressed Gas

REFER ALSO TO CITATION(S) 19224

2503 Pumped Hydro

REFER ALSO TO CITATION(S) 19224

2505 Flywheels

REFER ALSO TO CITATION(S) 18732

2506 Thermal

18629 **Energy storage via desiccants for food/agricultural applications.** Miller, W.M. (Univ. of Florida, Lake Alfred). *Energy in Agriculture;* **2**: No. 4, 341-354(Dec 1983).

Energy storage has become an important consideration in adopting solar energy or providing energy during interruptable service of fossil fuels. Desiccants are a potential media especially suited for drying applications. Both liquid and solid desiccants are manufactured and could be used in small or large scale drying for crop or food product drying. This report reviews the applications of combining solar energy and desiccant energy storage. Various physical and thermal properties have been compiled. A cost comparison revealed that energy storage. Various physical and thermal properties have been compiled. A cost comparison revealed that energy storage via desiccants was competitive with phase-change materials, rock-bed storages and water systems. 46 references, 3 figures, 3 tables.

2509 Batteries

REFER ALSO TO CITATION(S) 18729, 18730, 18732, 18733, 18861

18630 **(CONF-830859—13) Dimensional analysis and scale-up of electrochemical reactors.** Selman, J.R. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemical Engineering). 1983. Contract AC02-77ER04445. 10p. NTIS, PC A02; 3; GPO Dep. Order Number DE84009103.

From National meeting of the American Institute of Chemical Engineers; Denver, CO, USA (28 Aug 1983).

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This introductory paper deals with the special aspects of dimensional analysis as applied to electrochemical reactors. Differences with scale-up procedures in chemical reactors are emphasized, and the role of mathematical modeling in scale-up is discussed by means of two examples.

18631 **(LBL—17058) Advanced electrochemical energy storage systems.** Cairns, E.J. (Lawrence Berkeley Lab., CA (USA)). 12 Dec 1983. Contract AC03-76SF00098. 55p. (CONF-831273—1). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008245.

From Royal Swedish Academy of Engineering Sciences energy storage conference; Stockholm, Sweden (12 Dec 1983).

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The requirements for stationary energy storage and for electric vehicle batteries will be indicated. The field of advanced rechargeable batteries will be reviewed with emphasis on the most promising systems. Status reports, problem areas, and opportunities for future development will be given. Areas for special contributions from Sweden will be identified.

18632 **(UCID—20023) Aluminum-air research and development program. Summary report - FY 1982.** Cooper, J.F. (Lawrence Livermore National Lab., CA (USA)). Apr 1983. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008360.

The aluminum-air program in 1982 focused on the following research areas: (1) experimental investigation of alternative cell configurations, (2) testing of specific configurations in multicell stacks, (3) long-term testing of air-electrodes under simulated vehicle duty cycles, (4) determination of kinetic of aluminum trihydroxide crystallization under candidate battery operating conditions, and (5) studies of anode behavior of alloys containing minor impurities such as iron, manganese, gallium, and phosphorus. The major achievements of this work period were: (1) The operation of six-celled and two-cell stacks without degradation of performance compared to laboratory baseline cells. (2) Redesign of solution-side current collection grid and successful application to wedge-shaped cells on the engineering scale (600 cm^2); demonstration of ability of such cells for continuous anode feed and rapid refueling. (3) Fabrication and testing of air electrodes catalyzed with certain macrocylic complexes; extension of cycle life to above 1000 standard drive cycles using non-noble metal catalysts. (4) Determination of role of minor electrolyte additions and precipitated $Al(OH)_3$ on air electrode life. (5) Development of a comprehensive mathematical model of aluminum trihydroxide precipitation under battery conditions.

18633 **(UCRL—90465) Aluminum-air power cell research and development. Progress report.** Cooper, J.F. (Lawrence Livermore National Lab., CA (USA)). 22 Feb 1984. Contract W-7405-ENG-48. 34p. (CONF-831272—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008328.

From EHV systems assessment seminar; Gainesville, FL, USA (14 Dec 1983).

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An aluminum-air battery is under development with the objective of providing an electric vehicle with the range, acceleration and rapid refueling capability of common automobiles. From tested refuelable cell designs, a wedge-shaped cell was chosen for mechanical simplicity and for its capability of full anode utilization and rapid partial- or full-recharge. The cell uses tin-plated copper tracks to maintain a constant interelectrode separation and to collect anodic current. Rectangular slabs of aluminum enter the cell under gravity feed and gradually assume the wedge shape during dissolution. The feed is constant and continuous and tin/aluminum junction losses are 7 mV at 2 kA/m^2. A second generation wedge cell has been developed which incorporates air- and electrolyte-manifolding into individually-replaceable air-cathode cassettes. A prototype wedge cell using replaceable cassettes was operated simultaneously with a crystallizer, which stabilized aluminate concentration and produced a granular aluminum-trihydroxide reaction product. Electrolyte was circulated between cell and fluidized-bed crystallizer, and particles of sizes greater than 0.015 mm were retained within the crystallizer using a hydrocyclone. Air electrodes have been tested over simulated vehicle drive cycles. Electrodes using advanced sintering and wet-proofing techniques and catalyzed with a non-noble metal catalyst (CoTMPP) have been operated for over 1400 drive-cycles. Fuel costs of $1.72/kg-Al (installed) were estimated on the basis of model alloy production and distribution costs, leading to a projected operating cost of 8-10 cents/mile, depending on alloy and vehicle drive-train efficiencies. Unalloyed aluminum yields a peak of 4.5 kWh/kg, while an advanced industrial Hall Process and the pilot-plant Alcoa Smelting Process have electrical energy consumptions of 11.3- and 8.3 kWh/kg, respectively.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 19582

18634 **(DOE/EIA—0173(83)) Annual report to Congress, 1983.** (USDOE Energy Information Administration, Washington, DC). Mar 1984. 73p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. Order Number DE84007697.

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The agency focused on issues of overriding importance to energy decisionmakers, including nuclear plant cancellations, coal exports, acid rain implications for electric utilities, natural gas deregulation, and the effects of possible world oil supply disruptions on the US economy. This wide variety of energy information contributed significantly to public debate on topical energy issues. The EIA program to consolidate energy information into one or two central publications for each energy source-coal, electricity, natural gas, petroleum, nuclear and alternate fuels-made obtaining energy information easier for the agency's wide range of users. Consolidation of information promoted a cost saving and decreased respondent burden. During the year, EIA continued to manage the respondent burden control program for the Department of Energy and far surpassed all the burden reduction goals established by the Paperwork Reduction Act and the Office of Management and Budget in the last 3 years. In 1983, DOE reduced its reporting burden by 3.2 million hours from the previous year, a savings not only to industry but to the taxpayer as well. EIA completed three major efforts to review, strengthen, and improve its petroleum surveys, resulting in the consolidation of ten collection forms into three. In conjunction with the effort to improve the timeliness and quality of its energy data, EIA completed a year-long project in the petroleum supply data area improving surveys and methodology. New emphasis was placed on the quality of weekly petroleum surveys, enabling a 1-day-earlier release of the vital Weekly Petroleum Status Report, widely used by industry and business.

18635 **(DOE/IG—0203) Procurement closeouts.** (USDOE Office of Inspector General, Washington, DC). 16 Mar 1984. 19p. TIC, PO Bx 62, Oak Ridge, TN 37831.

Report to The Secretary.

Our review at the Department's three largest procurement offices disclosed that contracts and grants were not being closed out in a timely manner, and that many of the lower valued contracts and grants were being closed out without an adequate field or desk audit being performed. Timely closeout of procurement instruments was hampered by problems in obtaining (1) program office certification that required goods and services were provided to the Department, (2) necessary closeout information from the contractor or grantee, or (3) audit coverage when required. The Director, Procurement and Assistance Management, has taken or agreed to take corrective action on our recommended improvements. Findings and concerns were discussed with management. This led to early implementation of some specific corrective actions. These corrective actions, together with other management initiatives, had reduced the backlog of inactive contracts and grants from 15,747 in January 1983 to 12,424 at the beginning of February 1984.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 18041, 18637, 18648, 18654

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 18038, 18641, 18659, 18661, 18662, 19126

18636 (OTA—4900518) Economic importance of the small miner and small mining businesses in Alaska. Hawley, C.C.; Whitney, J.W.; Wobber, F.J. (Hawley (C.C.) and Associates, Anchorage, AK (USA)). Nov 1977. 38p. NTIS, PC A03/MF A01. Order Number DE84900518.

This study documents the economic characteristics of the small mining industry in Alaska, including both mine production and mineral deposit discovery. Economic effects on business activities in Alaska are considered. The study is largely qualitative in nature. It is based on state economic statistics, data obtained from state and federal government agencies, interviews, and indirect evaluation. Direct and indirect effects on employment, purchase and maintenance of heavy equipment, fuels, other consumables, and transportation are identified.

18637 (OTA-C—166) Comparative access of selected minerals to transport in Alaska and Continental United States. (Pan-Technology Consulting Corp., Inc., Washington, DC (USA)). 26 Sep 1977. 41p. NTIS, PC A03/MF A01. Order Number DE84900519.

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The relative access of hard rock mineral deposits in Alaska to transport was analyzed in terms of: roads, railroads, airports and waterways. Four such minerals were selected for analysis because of their importance in the US economy. They were: chromite, nickel, tungsten and uranium. The United States has been divided into three major areas for a comparison of transport accessability. The areas are the East, the Far West and Alaska (Hawaii has been excluded). The characteristics of each area (i.e., transport network density, development) vary considerably and and while the Far West is most similar to Alaska, Alaska is relatively well below the development of both the other two areas. Of the three areas, the East has the highest population density and a highly intensive economic development. These two factors suggest reasons for a dense transport network; the highest number of miles of all four transport modes is found in the East.

18638 (PB—84-136829) World oilseed situation and U.S. export opportunities, December 1983. Foreign agriculture circular. (Foreign Agricultural Service, Washington, DC (USA)). Dec 1983. 49p. NTIS, PC A03/MF A01.

A slight increase in world oilseed production above last month's forecast, to 163.0 million tons, still leaves 1983/84 production over 9 percent below last year. Forecast utilization of oilseeds and products remain essentially unchanged from last month. Despite the relatively unchanged world oilseed and product balance, prices have weakened in recent weeks, raising expectations that additional price strength will be needed to bring about the required rationing of reduced world supplies. The other major element of uncertainty is Southern Hemisphere oilseed production, especially the Brazilian and Argentine 1984 soybean crops.

18639 (PB—84-150382) World labour report: employment, incomes, social protection, new information technology. (International Labour Organization, Geneva (Switzerland)). 1984. 221p. NTIS, PC $25.65.

The report provides a comprehensive review of recent developments concerning major labor problems in the contemporary world. The report is concerned mainly with facts, intended for people everywhere who are concerned with these problems. It examines employment in the world today, in the least developed countries, in the industrialized market economy countries, and in the centrally planned economy countries. It goes on to an analysis of economic migration for employment, to a review of incomes and wages in the world, current social security problems, and the impact of new information technologies. It concludes with statistical data on the world labor force, income distribution and social security.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 18038, 18261, 18639, 18659, 18660, 18661, 19025, 19040, 19057, 19060, 19126, 19128

18640 (DOE/PE—0048) US Department of Energy Federal and Contractor Environmental, Safety and Health Personnel and Federal Quality Assurance Personnel. (USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC). Apr 1984. 50p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009964.

This updated directory gives organizational location and both commercial and federal telecommunications telephone numbers. An index of DOE Offices is included. (PSB)

18641 (LBL—15075) Distributed data management in a minicomputer network: the SEEDIS experience. Merrill, D.; McCarthy, J.; Gey, F.; Holmes, H. (Lawrence Berkeley Lab., CA (USA)). 7 Oct 1982. Contract AC03-76SF00098. 8p. (CONF-8210120—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008008.

From Intergrated data users workshop; Reston, VA, USA (13 Oct 1982).

This paper describes distributed data management aspects of SEEDIS (Socio-Economic Environmental Demographic Information System). SEEDIS is an experimental system for the retrieval, analysis, and display of geographically linked data. SEEDIS operates on nine computers in a nationwide network. Users at any location select and retrieve all data in the same way, regardless of whether they are stored locally or at a remote location. The network implementation has been substantially modified during 1983. New enhancements include: local caching of data files to improve efficiency; linking to an automatic tape library (ATL) to make larger volumes of data accessible; node independence to facilitate automatic sharing of data among autonomous SEEDIS installations without the need for central control; improvements providing robust operation despite unreliable network connections; and automatic recording of all cache transactions for subsequent statistical analysis.

18642 (NP—4900896) Summary of current and planned activities in the program area environmental dimensions of energy policies. Siddiqi, T.; Gilbert, J.; Van Dyke, J.; Webber, H.; Wiebe, J. (East-West Center, Honolulu, HI (USA)). Jun 1983. 34p. NTIS, PC A03/MF A01. Order Number DE84900896.

Progress is reported on efforts to provide policy-makers with analyses that identify potential difficulties in simultaneously achieving the energy and environmental goals of the countries in Asia, Pacific, and North America; to examine approaches that could be useful in meeting both energy and environmental objectives, and assess their applicability under the varying circumstances prevailing in different parts of the region; and to produce educational materials authored by multi-country teams, that might be useful to policy-makers and practicing professionals dealing with the energy-environment interface. Work is presently being undertaken in the following program areas: the increased use of coal in the Asia-Pacific region: achieving energy and environmental goals; legal and environmental factors affecting the management of radioactive wastes; environmental guidelines for offshore oil and gas exploration and production; and rural biomass fuels and air pollution.

18643 (PB—84-129386) Promising site cleanup technology. Hill, R.D. (Environmental Protection Agency, Cincinnati, OH (USA). Municipal Environmental Research Lab.). Jan 1984. 18p. (EPA—600/D-84-006). NTIS, PC A02/MF A01.

Within the EPA Office of Research and Development, the Solid and Hazardous Waste Research Division (SHWRD), Municipal Environmental Research Laboratory, has the responsibility for the control development program in support of 'Superfund.' The SHWRD research and development program has been organized to correspond with the 'Superfund' legislation, i.e. the Oil and Hazardous Materials Spills Branch deals with removal actions (emergency), and the Disposal Branch deals with remedial actions. Due to

the special demands of 'Superfund,' the normal research and development process of concept development, laboratory evaluation, pilot testing, and field demonstration cannot be followed. 'Superfund' is a 5-year program requiring answers today. Thus, the program is one of technology assessment to determine cost and effectiveness, adaptation of technologies to the uncontrolled waste site problem, field evaluation of technologies that show promise, development of guidance material for the EPA Office of Emergency and Remedial Response (OERR), technical assistance to OERR, and EPA Regional Offices. An overview of the program is presented.

18644 **(PB—84-139435) Retrofit cost relationships for hazardous waste incineration. Report for 1 June 1982-1 July 1983.** Lim, K.; DeRosier, R.; Larkin, R.; McCormick, R. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Jan 1984. 71p. NTIS, PC A04/MF A01.

This study reports a methodology, and an accompanying set of empirical cost relationships, that can be used to estimate the costs of retrofitting/upgrading various components of existing hazardous waste incineration facilities to comply with RCRA performance requirements. Both the methodology and the retrofit cost relationships were intended to focus on major capital additions or subsystem modifications that could be required for RCRA compliance. The results of the study are expressed in a series of empirical relationships between the costs for various capital modifications/additions and factors that significantly impact these costs, e.g., capacity, materials of construction, etc. Costs are developed for (1) various aspects of combustion system retrofit to improve destruction of toxic waste constituents, (2) scrubbing system component addition, replacement, or upgrading to improve particulate and/or HC1 removal, and (3) addition or replacement of ancillary equipment mandated by combustion or scrubbing system retrofit. The costs are based on a combination of in-house engineering and vendor-supplied budgetary cost estimates.

18645 **(TVA/ONR/LFR—83/8) Wildlife benefit simulations in the FORMAN program.** Williamson, J.F. Jr. (Tennessee Valley Authority, Norris (USA). Div. of Land and Forest Resources). Jan 1983. 22p. NTIS, PC A02/MF A01. Order Number DE84900353.

FORMAN is an interactive, multiobjective forest resource optimization program developed by the Office of Natural Resources of TVA. This microcomputer-based program can provide improved land management and planning to forest landowners. Benefits subject to optimization include both timber (i.e., present net worth of timber and cords produced) and nontimber benefits, expressed as habitat suitability indices for three game species (white-tailed deer, bobwhite quail, and gray squirrel). Habitat suitability indices are functions of common stand parameters: age, type, diameter at breast height, basal area, time since thinning, as well as physiographic region and landform. Nontimber benefit simulations (i.e., the derivation of a representative index of habitat suitability for each of the three wildlife species) used within FORMAN are discussed in detail. 19 references, 3 tables.

2904 Natural Resources

REFER ALSO TO CITATION(S) 18647

18646 **(HMI—B-397) TELLUS 2030.** Zimen, K.E. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Kernchemie und Reaktor). Mar 1983. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750502.

The development of the systems parameters like population, food, and energy is extrapolated according to a logistic function in relation to the recent development diagrams for a period of prognosis of 3-5 decades. A development of population is expected which amount to 10-15 billion people in the year 2100. The problem of food supply must be chiefly seen in the disproportionate distribution of food. In the long term there shall be no danger of energy shortage, at least as far as the scientific and technical facilities are concerned. In the appendix the controversies about the "limits of growth", the "growth of limits" and about the population explosion and economic aids to developing countries are commented upon.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 18123

18647 **(NP—4770174) Outline programme on raw materials research: Annual report 1981 on chemical feedstocks and natural materials, renewable resources.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Rohstofforschung). [nd]. 236p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84770174.

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The objective of the Federal Government's Research Programme on Raw Materials and Technologies is to ensure in the medium and long term an economically favourable and stable supply of the Federal Republic with raw materials and chemical feedstocks and to improve the technologies pertaining to raw materials, working fluids and chemical feedstocks. The programme is planned to support the German raw materials, feedstocks and working fluids industries and system construction industries to enable them to be competitive and strong international contracting and cooperating partners with highly developed know-how and the latest technologies, also in the medium and long term. Transfer of technologies to developing and threshold countries is an essential part of the programme. The programme has two aspects which often cannot be separated from each other when the projects are being carried out. The programme is: a) a programme on raw materials taking into account the aspect of the raw and basic materials which are politically not available or less available and are decreasing physically. Thus the programme is expected to expand the basis of raw materials and to create the technical and scientific preconditions of recycling and of an economical application of valuable materials and substituting them by other materials; b) a programme on technologies which is expected to support the technical and scientific progress in the fields of raw materials, chemical feedstocks and working fluids. The R and D programmes referred to in this annual report accompany and complete the programme on raw materials research and technologies: programme on energy research and technologies, programme on marine research and engineering, programme on environmental research, programme on the humanisation of the work.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 18111, 18112, 18113, 18117, 18118, 18123, 18127, 18128, 18129, 18130, 18131, 18132, 18148, 18149, 18150, 18159, 18665, 19583

18648 **(DOE/EIA—0436(83)) World nuclear fuel cycle requirements 1983.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Feb 1984. 64p. NTIS, PC A04/MF A01 - GPO; GPO Dep. Order Number DE84001799.

This analysis report presents projections of uranium requirements (both yellowcake and enrichment services) and spent fuel discharges corresponding to the nuclear power plant capacity projections presented in Commercial Nuclear Power: Prospects for the United States and the World (DOE/EIA-0438) and the 1982 Annual Energy Outlook [DOE/EIA-0438 and the 1982 Annual Energy Outlook [DOE/EIA-0383(82)]. Domestic projections are provided through the year 2020 and foreign projections through 2000. The domestic projections through 1990 are consistent with the integrated energy forecasts in the 1982 Annual Energy Outlook. Projections of nuclear power capacity beyond 1990 were not part of an integrated energy forecast; the methodology for their development is explained in Commercial Nuclear Power (DOE/EIA-0438). A range of estimates is provided, in order to capture the uncertainty inherent in such forward projections. This report is intended for Congress, Federal and State agencies, the nuclear industry, and the general public. It should be of particular interest to analysts involved in long-term planning for the disposition of radioactive waste generated from the nuclear fuel cycle.

18649 **(KTA-GS—40) KTA 2. progress report 1982.** (Kerntechnischer Ausschuss (KTA), Koeln (Germany, F.R.)). Aug 1983. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750739.

A survey of KTA (Commission on nuclear engineering, activities is given, covering also the activities of related bodies as well as how KTA regulation-making projects were carried out between the 29th and 30th KTA meeting (March 31, 1982 to June 22, 1982). The review of work done on regulations has been prepared in agreement with the chairmen of committees and subcommitees. The report is intended to give brief, clear and proper information on the present state of KTA activities.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 18716, 18717, 18718, 18724

18650 **(ESC—24) Cogeneration and energy parks.** Duijves, K.A.; Kruijswijk, B.J. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Jul 1983. 115p. (In Dutch). Stichting Energieonderzoek Centrum Nederland (ECN), Energie Studie Centrum, Petten, Netherlands.

The use of cogeneration in the industrial sector is discussed. The application of a cogeneration unit which serves a number of nearby companies has been highlighted. From an existing database on emissions, clusters of companies were identified which met criteria on having a maximum thermal need of 28 MW/SUB/t/SUB/h and being situated in an area of 4 by 4 km. A capacity of 28 MW// SUB/t/SUB/h was considered a minimum for the use of coal fired equipment, while the size of the area is set by the maximum distance steam can be transported economically. Data on the use of steam and electricity of these companies was obtained from a survey. Based on this information, 34 possible cluster locations were identified. A more detailed check with topographical maps reduced the number of 17 locations which are recommended to be examined in more detail. Technical/economic evaluations are presented for different cogeneration units, on coal (boiler with a back pressure turbine) and on gas (gas turbine/waste heat boiler combination). These evaluations are mainly based on data, generated by an accounting-model developed for the purpose and containing 13 different variables on technical and economic items. Effects of parameters like run-hours, steam conditions, lifetime of the installation, power demand and fuel and electricity prices have been investigated by means of cash flows, pay-back, rentability and present value data. (In Dutch)

2910 Conservation

REFER ALSO TO CITATION(S) 18057, 18662

18651 **(NP—4770173) Problems of energy conservation in the residential sector.** Meyer-Renschhausen, M. (Oldenburg Univ. (Germany, F.R.)). Sep 1982. 24p. (In German). NTIS (US Sales Only), MF A01. Order Number DE84770173.

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After a short glance on the energy price increases of 1973/74 as well as of 1979/81 and their effects on the households the quantitative importance of the problem is presented. The causes of the relatively few investment activities of house-owners concerning energy conservation are explained and some strategies for the support of energy conservation in residential buildings are suggested.

18652 **(NP—4770176) Efficiency of the energy saving programme.** Meyer-Renschhausen, M. (Oldenburg Univ. (Germany, F.R.)). Oct 1982. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770176.

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The energy-political part of the law (energy saving programme) is to last until the end of 1982. In total, 4,35 billion DM are provided, 2,34 billion of which are to be used for subsidies, 2.01 billion for tax abatements. The parties in the German Bundestag are in agreement that the "energy saving programme" is to be continued within the framework of a directly following programme. They are arguing, however, about which concrete measures to support and how to design the supporting means. Especially the SPD is demanding that a relatively broad range of measures should be supported and that these measures should be subsidised at least to the same degree as special depreciations. The CDU/CSU, however, demands to eliminate heat-insulating measures from the catalogue in favour of new heating technologies and to establish the special depreciations as the main means of support. A substantial reason for the disagreement on the final form of the directly following programme is due to the differing assessments of the success of the programme up to now. The former government coalition calls it generally successful while representatives of the CDU/CSU name it a failure (petition of CDU/CSU, 1981, p. 10). The following explanations aim is to review the programme at several criteria, to discuss the alterations proposed by the government and by the opposition for the future designing of the programme, and to develop approaches for an efficient programme.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 18648

18653 **(DOE/EIA—0409) Model documentation: household model of energy.** Holte, J.A. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Feb 1984. 112p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84007585.

The Household Model of Energy is an econometric model, meaning that energy use is determined quantitatively with the use of economic variables such as fuel prices and income. HOME is also primarily a structural model, meaning that energy use is determined as the result of interactions of intermediate components such as the number of households, the end use fuel shares and the energy use per household. HOME forecasts energy consumption in all occupied residential structures (households) in the United States on an annual basis through 1990. The forecasts are made based upon a number of initial conditions in 1980, various estimated elasticities, various parameters and assumptions, and a set of forecasted fuel prices and income. In addition to the structural detail, HOME operates on a more disaggregated level. This includes four end-use services (space heating, water heating, air conditioning, and others), up to seven fuel/technology types (dependent upon the end use service), two housing types, four structure vintages, and four Census regions. When the model is run as a module in IFFS, a sharing scheme further disaggregates the model to 10 Federal regions.

18654 **(NP—4770175) Substitutional relationships between energy sources in Switzerland 1968-1980.** Kugler, P. (Basel Univ. (Switzerland). Inst. fuer Angewandte Wirtschaftsforschung). Sep 1982. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770175.

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The structure of the final energy consumption in Switzerland has been changing strongly during the 70ies. The share of petroleum derivatives decreased in this period from 77.5 to 72.5 while the final electricity and gas consumptions were increased from 16.1 to 18.9 and 0.5 to 5.0 respectively. The two dramatic rises of petroleum prices in 1973 and 1979 resulted in a strong movement of the relative prices of energy sources. So we are confronted with the question of how far the changes in the structure of the final energy structure were caused by this price development. This investigation contains some empiric results relating to these problems. The substitutional relationships between petroleum derivatives, electricity, gas, and solid fuels were analysed within the framework of a dynamic translog model. This was done by estimating separate models for the energy demands of the household and industrial sections with quarterly data relating to the years of 1968-1980 and 1973-1983 resp. The investigation is sectioned as follows: section 2 contains the presentation of the used model. The empiric results relating to the industrial sphere are in section 3, those relating to households in section 4. The paper also contains conclusions and an appendix of data.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 18008, 18056, 18061, 18159, 18642, 18652, 19057

18655 (DOE/CS/65004—T2) Urban energy strategies for the eighties: a self-help guide for local decision-makers. (Cooper Union Research Foundation, New York (USA)). Jun 1982. Contract FG01-80CS65004. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007904.

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Energy project financing involves a wide range of actions which can only take place in an environment of enlightened public-private cooperation. Energy supply and production highlights the importance of coal as well as certain emerging energy technologies in helping localities achieve greater energy self-sufficiency. How energy-efficiency and production projects may be used to spur economic development in low-income communities is described. The many opportunities for local governments and utility companies to work together to achieve mutually beneficial objectives are detailed. Several broad policy considerations which should help guide local officials in setting up and running the energy office are outlined. The formulation of an energy data base and, in turn, the application of the data base to energy management and capital investment decisions are presented. The considerable array of nonfinancial incentives which, when applied in combination with other regulatory and tax measures, can effectively unleash private capital for investment in energy efficiency are highlighted. The objectives and methodology of contingency planning are outlined, with special attention given to private sector participation in all phases of the process. Finally, the substantial opportunities for local government to promote energy efficiency in transportation are described.

18656 (DOE/RG/08683—T8) Task 2B deliverable utilities characteristics profile. (National Regulatory Research Inst., Columbus, OH (USA)). 28 Feb 1978. Contract AC01-77RG08683. 566p. NTIS, PC A24/MF A01; 1; GPO Dep. Order Number DE84006371.

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This Utilities Characteristics Profile is a set of data on electric and gas utilities. The profile provides data on electric and gas use in the nine Electric Reliability Council regions, the fifty states and the District of Columbia. It also provides data on all class A and B electric utilities, the major gas utilities in each state, the twenty largest municipally owned electric utilities and the twenty largest municipally owned gas utilities in the nation. The profile was developed to assist in planning utility energy conservation programs for state utility regulatory agencies and non-regulated utilities.

18657 (DOE/RG/08683—T9) Task 2A deliverable regulatory characteristics profile. (National Regulatory Research Inst., Columbus, OH (USA)). 13 Mar 1978. Contract AC01-77RG08683. 271p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84006376.

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This Regulatory Characteristics Profile is a collection of information on state public utilities commissions, state energy agencies, the twenty largest municipal gas utilities and the twenty largest municipal electric utilities. The profile was developed to assist in recommending and selecting states and municipalities for technical assistance in the design, implementation or evaluation of energy conservation and management programs.

18658 (DOE/RG/08683—T10) Regulatory Assistance Program: on-site technical assistance package. (National Regulatory Research Inst., Columbus, OH (USA)). Feb 1978. Contract AC01-77RG08683. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84006369.

The National Regulatory Research Institute was established by the National Association of Regulatory Utility Commissioners (NARUC) to provide NARUC members with a high-quality research and technical assistance resource. The Institute initiated the Regulatory Assistance Program in September 1977 under a one-year contract with the US Department of Energy. The objective of the program is to assist state regulatory agencies, state energy offices, and non-regulated utilities with the development and implementation of utility-related energy management and conservation measures, including rate design, forecasting, planning and consumer programs.

18659 (NP—4900871) Florida Energy Research and Development Agenda. (Florida Energy Research and Development Task Force, Tallahassee (USA)). May 1983. 17p. NTIS, PC A02/MF A01. Order Number DE84900871.

To maximize the positive impact on Florida, research and development efforts must focus on issues of special interest to the state. Florida's situation varies from that of many other states because of its prospects for continued rapid population growth, its high dependence on petroleum, and its warm, humid climate. Although Florida can benefit from energy studies done elsewhere, attention should be directed toward studies focusing on the state's specific characteristics and needs. The Florida Energy Research and Development Task Force recommends that energy efficiency and renewable energy resources receive a strong emphasis in state-sponsored research and development programs. The Task Force considers these two alternatives, along with the intelligent use of conventional fuels, to be the important sources of energy to support the continued growth Florida will experience. Implementation of the Task Force recommendations presented herein will provide a beginning toward an economically sound and a politically workable solution for Florida's energy needs. Moreover, the program should improve economic development by encouraging emerging energy technologies and by lessening Florida's dependence on non-renewable energy sources.

18660 (P—300-83-007) Annual petroleum review. Executive summary. 1982 annual report to the Legislature. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Jul 1983. 29p. California Energy Commission, 1516 9th Street, Sacramento, CA 95814.

Key issues of each chapter are described with conclusions and recommendations.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 17994, 18038, 18041, 18051, 18052, 18054, 18055, 18056, 18061, 18062, 18063, 18064, 18090, 18401, 18660, 19126

18661 (CONF-831112—7) Impacts of acid rain legislation. Addison, E.L. (Southern Co., Atlanta, GA (USA)). 1983. 11p. NTIS, PC A02/MF A01. Order Number DE84900876.

From Coal technology '83 - international coal utilization convention; Houston, TX, USA (15 Nov 1983).

The author warns against hasty acid rain legislation that would involve billions of dollars and affect thousands of jobs. He recommends further study into the causes of high acidity in lakes and streams. He states that there are too many uncertainties of whether the problem would be solved by reducing sulfur dioxide emissions from coal-fired power plants. (DMC)

18662 (DOE/CS/20542—T1) Increasing benefits of energy assistance programs through oil furnace retrofits. (Pennsylvania State Government, Harrisburg (USA)). Jul 1981. Contract FG01-79CS20542. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84007305.

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Four million low income households in the Unites States heat with fuel oil. Those in colder climates are confronting severe hardships. The Fuel Oil Marketing Advisory Committee (FOMAC) of the US Department of Energy (DOE) has documented the desperate nature of this situation, which continues to worsen as prices rise. For FY 1982, the Administration has proposed that HHS administer a four-year block grant to states combining LIEAP with emergency assistance to the needy, and has requested an authorization of $1.875 billion annually for the two combined programs. HHS has taken the position that states should now have the option of using Low Income Energy Assistance Program (LIEAP) monies for low cost weatherization including furnace retrofits. This report

is intended for those who may be involved in making decisions about the nature of future energy assistance programs. The major sections of the report are evaluation of the Phildelphia Pilot Program, economics of an Oil Furnace Retrofit Program, and administrators' considerations. Each section is supported by appendices as listed in the table of contents.

2960 Electric Power

REFER ALSO TO CITATION(S) 18417

18663 (DOE/CE—0076) Federal Energy Management Program: life cycle cost manual (NBS 135) update. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Mar 1984. 39p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009106.

Updated tables are presented for use in Life Cycle Cost analyses as required by the National Energy Conservation Policy Act (NECPA) of 1978. There are two sets of tables: One set is based on a 7 percent discount factor as required by NECPA, as amended; the other set is based on the 10 percent discount factor as required by OMB Circular A-94. The Appendix C tables, DOE-Projected Energy Prices and Escalation Rates, were provided by Energy Information Administration. Note that the C tables are expressed in 1983 dollars and are based on average prices. The projections shown are based on the Short Term Energy Outlook, November 1983, The Annual Energy Outlook, April 1983, and some proportional relationships for the period 1995 through 2000. The Short Term Integrated Forecasting System (STIFS) was used to project selected 1983 prices, and the Intermediate Future Forecasting System (IEES) was used to develop the 1985 and 1990 projections. The 1995 and 2000 projections were derived using simple rules, proportional relationships and analytical judgment. In the A and B Tables, the relationships were projected to year 2007.

18664 (DOE/EIA—0226(83/12)) Electric power monthly, December 1983. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Mar 1984. 42p. NTIS, PC A03/MF A01 - GPO; GPO Dep. Order Number DE84008337.

During December 1983, net generation by electric utilities in the United States was 212,241 gigawatthours (GWh). On a year-to-date basis, net generation at the end of December 1983 was 3.0% higher than for the same period in 1982. In December, coal accounted for 55.2% of all electricity produced, petroleum for 7.6%, gas for 9.7%, nuclear power for 12.4%, hydroelectric power for 14.9%, with the remaining 0.2% from geothermal, wood, and waste. In December 1983, electric utilities consumed 59,117 thousand short tons of coal. Petroleum consumption in December 1983 was 27,471 thousand barrels, while gas consumption was 219,098 million cubic feet. On a year-to-date basis, coal consumption at the end of December 1983 was 5.4% higher than the same period in 1982; petroleum consumption was 1.8% lower than the same period in 1982; and gas consumption was 9.7% lower.

18665 (ORNL/TM—8958) Regional projections of nuclear and fossil electric power generation costs. Smolen, G.R.; Delene, J.G.; Fuller, L.C.; Bowers, H.I. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract AC05-84OR21400. 119p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84007499.

The total busbar electric generating costs were estimated for locations in ten regions of the United States for base load nuclear and coal-fired power plants with a startup date of January 1995. A complete data set is supplied which specifies each parameter used to obtain the comparative results. When the comparison is based on reference cost parameters, nuclear- and coal-fired generation costs are found to be very close in most regions of the country. Nuclear power is favored in the South Atlantic region where coal must be transported over long distances, while coal-fired generation is favored in the Central and North Central regions where large reserves of cheaply mineable coal exist. The reference data set reflects recent electric utility construction experience. Significantly lower nuclear capital investment costs would result if regulatory reform and improved construction practices were instituted. The electric power generation costs for base load oil- and natural gas-fired plants were also estimated. These plants were found to be noncompetitive in all regions for those scenarios most likely to develop. Generation cost sensitivity to changes in various parameters was examined at a reference location. The sensitivity parameters included capital investment costs, lead times, capacity factors, costs of money, and coal and uranium prices. In addition to the levelized lifetime costs, year-by-year cash flows and revenue requirements are presented. The report concludes with an analysis of the economic merits of recycling spent fuel in light-water reactors.

18666 (TVA/OP/EUDR—81/4(79-83)) Statistics distributors of TVA power. Fiscal years 1979-1983. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Use and Distributor Relations). 1983. 190p. NTIS, PC A09/MF A01. Order Number DE84900785.

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Degree-days for the winter of 1982-1983 were 4% less than normal and 8% lower than the previous winter. Because of warmer weather and conservation efforts, total sales by the distributors decreased by 3% during fiscal year 1983. Residential average use decreased from 13,894 kWh to 13,155 kWh. Revenue per kWh increased by 4% and power cost per kWh increased by 2%. This increase was influenced by the Adjustment Addendum and Power Credits which went into effect October 2, 1982, the Special Power Credit during March 1982, and the Adjustment Addendum Credit which went into effect April 2, 1983. Operating expenses per consumer (excluding wholesale power cost) increased 4% in 1983. The increase in expenses per consumer for the four largest municipalities was 7%; and for the smaller municipalities and cooperatives, 3%. On a per kWh basis operating expenses increased 8%. The four largest municipalities showed a 11% increase; and the smaller municipalities and cooperatives, 7%.

18667 (TVA/OP/PINF—83/5) 1982 power program summary. Vol. I. (Tennessee Valley Authority, Chattanooga (USA). Office of Power). 1983. 75p. NTIS, PC A04/MF A01. Order Number DE84900632.

This report deals with TVA's electric power activities. This report, published in 2 volumes, provides a summary of TVA power and distributor operations in fiscal year 1982. Volume I data are based on the TVA fiscal year ending September 30, 1982. (DLC)

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 18654, 18709

18668 (DOE/EI/10085—T6) Residential energy consumption survey. Sample design and methodology - national household surveys: 1980, 1981, and 1982. Cohen, R.; Steinberg, J.; McBride, J.; Rhodes, I.; Slider, C. (Response Analysis Corp., Princeton, NJ (USA)). Aug 1983. Contract AC01-79EI10085;AC01-82EI11557. 146p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84002245.

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General aspects of the sample design as well as specific features of the methodology for 1980, 1981, and 1982 surveys are presented.

18669 (PB—84-142090) Energy and U.S. agriculture: Irrigation pumping, 1974. Agricultural economic report. Sloggett, G. (Economics and Statistics Service, Washington, DC (USA). Economic Development Div.). Sep 1977. 46p. (AER—376). NTIS, PC A03/MF A01.

In 1974, U.S. farmers irrigated over 35 million acres with water pumped from wells and from rivers and lakes. About 260 trillion Btus of energy costing $594 million were required to pump the water. Electricity was used to pump water on 15.6 million acres followed by natural gas, 10.6 million; diesel, 3.9 million; LPG, 3.3 million; and gasoline, 1.5 million acres.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 18323, 18331, 18629

18670 (TVA/ONR/LFR—83/18) Production and use of industrial wood and bark residues for 44 counties in Alabama, Georgia, Kentucky, and Mississippi. (Tennessee Valley Authority, Norris (USA). Div. of Land and Forest Resources). May 1983. 38p. NTIS, PC A03/MF A01. Order Number DE84900350.

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An estimate is given of the tons of industrial wood and bark residues produced and left unused in 44 of the 170 Tennessee Valley Authority (TVA) power service area counties in Alabama, Georgia, Kentucky, and Mississippi. This report supplements the data appearing in TVA's Technical Note B45 Production and Use of Industrial Wood and Bark Residues in the Tennessee Valley, 1979. Together, these reports present residue estimates for all the 201-county Tennessee Valley region. 6 tables.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 18402

18671 (DOE/NBM—4009195) Magnetohydrodynamic power generation, electromagnetic pumps, heat pipes, and thermionic convertors. Pierson, E.S.; Bonyhady, K.A.; Dunn, P.F.; Nathenson, R.D.; Uherka, K.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009195.

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The basic principles of operation, components, and design of MHD generators, electromagnetic pumps, heat pipes and thermionic converters are described. 66 references. (WHK)

3003 Thermoelectric Generators

18672 (LA—10000-PR) Space Nuclear Safety Program. Progress report. Bronisz, S.E. (comp.). (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007989.

This technical monthly report covers studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos National Laboratory. Most of the studies discussed here are ongoing. Results and conclusions described may change as the work continues.

3004 Thermionic Converters

REFER ALSO TO CITATION(S) 18671

3005 Fuel Cells

REFER ALSO TO CITATION(S) 18732

18673 (DOE/FE/60338—6) Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 6. Breault, R.D.; Briggs, T.A.; Congdon, J.V.; DeMarche, T.E.; Goller, G.J.; Hall, E.W.; McCloskey, M.W.; Mientek, A.P.; O'Brien, J.J.; Randall, S.A. (United Technologies Corp., South Windsor, CT (USA)). Oct 1983. Contract AC01-83FE60338. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007814.

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The Department of Energy has initiated this program to advance electric utility cell stack technology and to reduce cell stack cost. The cell stack has a nominal 10-ft^2 active area and operates at 120 psia/405°F with an initial average cell performance goal of 0.745 volts at 232 ASF. The program comprises six parallel phases, which culminate in a full-height, 10-ft^2 stack verification test. Progress is reported.

18674 (DOE/NASA/0241—12) Heat recovery subsystem and overall system integration of fuel cell on-site integrated energy systems. Final report. Mougin, L.J. (Trane Co., La Crosse, WI (USA)). 15 Jul 1983. Contract AI21-80ET17088. 135p. (NASA-CR—168309). NTIS, PC A07; 3; GPO Dep. Order Number DE84006738.

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The overall objective of this project was to determine the best HVAC (heating, ventilating and air conditioning) subsystem to interface with the Engelhard fuel cell system for application in commercial buildings. To accomplish this objective, the effects of several system and site specific parameters on the economic feasibility of fuel cell/HVAC systems were investigated. The fuel cell system provides electricity for an electric water chiller and for domestic electric needs. Supplemental electricity is purchased from the utility if needed. An excess of electricity generated by the fuel cell system can be sold to the utility. The fuel cell system also provides thermal energy which can be used for absorption cooling, space heating and domestic hot water. Thermal storage can be incorporated into the system. Thermal energy is also provided by an auxiliary boiler if needed to supplement the fuel cell system output. Fuel cell/HVAC systems were analyzed with the TRACE computer program. TRACE is an energy and economic analysis program that has been developed by The Trane Company. Results are detailed. (WHK)

18675 (DOE/NASA/0291—1) New applications for phosphoric acid fuel cells. Stickles, R.P.; Breuer, C.T. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Nov 1983. Contract AI21-80ET17088. 222p. (NASA-CR—168203). NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE84007582.

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New applications for phosphoric acid fuel cells were identified and evaluated. Candidates considered included all possibilities except grid connected electric utility applications, on-site total energy systems, industrial co-generation, opportunistic use of waste hydrogen, space and military applications, and applications smaller than 10 kW. Applications identified were screened, with the most promising subjected to technical and economic evaluation using a fuel cell and conventional power system data base developed in the study. The most promising applications appear to be the underground mine locomotive and the railroad locomotive. Also interesting is power for robotic submersibles and Arctic villages. The mine locomotive is particularly attractive since it is expected that the fuel cell could command a very high price and still be competitive with the conventionally used battery system. The railroad locomotive's attractiveness results from the (smaller) premium price which the fuel cell could command over the conventional diesel electric system based on its superior fuel efficiency, and on the large size of this market and the accompanying opportunities for manufacturing economy.

3008 Miscellaneous Converters

18676 (EGG-SE—6442) Thermomagnetic generator. Kirol, L.; Mills, J.; VanHaaften, D. (Idaho National Engineering Lab., Idaho Falls (USA)). Nov 1983. Contract AC07-76ID01570. 133p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84007685.

Cycles for producing electricity from heat utilizing the magnetocaloric effect have been considered. A thermomagnetic generator producing electricity directly without a mechanical interface has been studied analytically, with emphasis on low temperature (below 400 K) applications. Power density and efficiency higher than previously reported in the literature appear achievable. Practical machines may be possible, further study is justified. Areas for future investigation include identification of optimum materials and

verification of heat transfer correlations. Capital cost for a thermomagnetic generator is estimated to be comparable to the cost for commercially available low temperature organic Rankine cycle generators. Cycles utilizing chemical reactions to change magnetic properties have also been considered. Suitable reactions have been identified, further study is required to quantify performance.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

18677 (DOE/CH/10095—1) Monitoring inspections of ICP program ECM and TA grantees. Final report. (Arawak Consulting Corp., New York (USA)). Mar 1983. Contract AC02-82CH10095. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006731.

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The activities undertaken to review DOE grants to schools, hospitals and municipalities under the Institutional Conservation Program (ICP) are reported. This Final Report is the result of a review of statistics and findings gathered over the period of the contract. It is intended to highlight aspects of the monitoring project and to make recommendations. This report is organized into four sections: the steps taken in organizing and implementing the review; statistics regarding the 92 grants reviewed; some of the common factors which fostered success or problems in the administration of the ICP grants; and recommendations.

3201 Buildings

REFER ALSO TO CITATION(S) 18325, 18326, 18372, 18674, 19050

18678 (AD-A—135277/2) Energy impact analysis of the military construction - Army Building Delivery System. Final report. Leverenz, D.; Herron, D.; Stumpf, A.; Eidsmore, A. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Oct 1983. 71p. (CERL-TR-E—188). NTIS, PC A04/MF A01.

The objectives of this study were to do an energy impact analysis of the Military Construction -- Army (MCA) building delivery process to assess how energy conservation can be more effectively implemented into the process, and to recommend where additional work is needed to develop: (1) proposals for modifying the actions taken during the MCA process in order to make new Army facilities more energy efficient, (2) requirements for energy analysis tools and procedures to help improve energy conservation, and (3) research and development requirements for improving the energy efficiency of buildings. The results of the energy impact analysis show that the present MCA process does not hinder the delivery of energy-efficient buildings. However, the MCA process does not ensure that energy-efficient buildings will be delivered, nor does it encourage personnel involved in the MCA process to produce an energy-effective facility. Further, the energy impact analysis shows that while there are significant requirements in the MCA process for considering conservation and alternate energy sources, not enough guidance is available on how to effectively address those requirements. This report also shows that the MCA process assesses energy impacts primarily during the late concept and final design phases. Only a little attention is directed to energy impacts during planning, programming, early concept design or construction, even though decisions at these phases can significantly affect the energy consumption of the final building.

18679 (BMFT-FB-T—83-193) Reduction of heat insulation upon soaking of the insulation layer. Achtziger, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 24p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750492.

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The thermal protection of hollow masonry can be improved by introduction of a core insulation between the inner and outer shell. The quality of the thermal insulation is influenced by accumulating water. Its magnitude can be determined if in combination with the practical moisture content the increase of heat conductivity with the moisture content is known. The thermal conductivity of the insulating materials is to be determined in accordance with DIN 52 616 in the dry state and after soaking by water with different volume-related moisture contents. The interpolated thermal conductivity values from three measured values at 10°C average temperature are presented as a function of the pertinent moisture content. Fills of expanded polystyrene, perlite and granulated mineral fibres, insulating boards made of mineral fibres and in situ cellular plastics produced from urea-formaldehyde resin are investigated. The test results show a confirmation of the thermal conductivity values, which are fixed for the application of insulating materials in hollow masonry.

18680 (CONF-840124—5) Laboratory determination of frosting and defrosting losses for a high-efficiency air-source heat pump having a one-row spine fin outdoor heat exchanger. Miller, W.A. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 23p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007537.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting; Atlanta, GA, USA (29 Jan 1984).

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A high-efficiency, air-to-air, split-system residential heat pump of nominal 3-ton capacity was instrumented and tested in the heating mode under laboratory conditions. The coefficient of performance (COP) and heating capacity of the system were measured during steady-state, dehumidifying, and frosting-defrosting conditions, with major emphasis placed on the dynamic frosting operation of the system. The study encompassed an evaluation of system and component performance for ambient temperature levels between 8.3 and -8.3°C (47 and 17°F) and for discrete relative humidity levels ranging from 50 to 90%. The heat pump COP and capacity, measured under frosting conditions, decreased with time because of frost accumulation on the outdoor heat exchanger. Frosting caused greater degradation of heating capacity than did defrosting. Algorithms were developed as functions of time, wet-bulb temperature, and moist air enthalpy and are applicable to modeling of frosting losses calculated in a seasonal performance program.

18681 (DOE/CE/15095—9) Heat recovery ventilation for housing: air-to-air heat exchangers. (National Center for Appropriate Technology, Butte, MT (USA)). Mar 1984. Contract AC01-82CE15095. 33p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007877.

Air-to-air heat exchangers were researched and developed in the Appropriate Technology Small Grants Program, 1978 to 1981. This publication examines the results of this work as well as provides information for builders, architects and skilled owner-builders on the basics of using air-to-air heat exchangers in residential settings, including: how heat exchangers work; why they are needed and when they are appropriate; how to choose an adequate ventilation rate and a machine that fits the purpose; how to install, control and maintain the machine; assessing the state-of-the-art in this technology; and information on supplies, ventilation standards and where to go for further information on heat exchangers.

18682 (DOE/CS/15038—T1) Development of simple, cost-effective optimum temperature control for housing. Final performance report. (Count Digital Ltd., Arlington, MA (USA)). [nd]. Contract FG01-81CS15038. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007417.

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The direct objective of the R & D program for the SCOTCH system was to take the basic technology, through the stages of conceptual refinement and prototype experimentation to the point of a complete pre-production prototype. At the beginning of the program the theoretical basis for SCOTCH had been principally completed, and an early engineering prototype had been completed and tested. The principal elements of the system had been basically characterized, however the refinement and integration of the components had not been performed. The major components of SCOTCH are: the radiator cover heat-valve, local area communications system for system control, and the electronics for optimum closed loop control.

18683 **(DOE/CS/22046—T1-Vol.1) BEPS program manual. Volume 1.** (National Inst. of Building Sciences, Washington, DC (USA)). Sep 1980. Contract FC01-80CS22046. 357p. NTIS, PC A16/MF A01; 1; GPO Dep. Order Number DE84008192.

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The Building Energy Performance Standards (BEPS) Program Manual was produced to establish the basis for the future sound management of the overall BEPS program and for efficient and effective coordination and integration of the efforts of the many organizations who are contributing to the program. The following are included in this volume: organization and management, organization charts, administrative procedures, program work breakdown structure, and detailed subtasks and activity descriptions. (MHR)

18684 **(DOE/CS/22046—T1-Vol.2) BEPS program manual. Volume 2.** (National Inst. of Building Sciences, Washington, DC (USA)). Sep 1980. Contract FC01-80CS22046. 355p. NTIS, PC A16/MF A01; GPO Dep. Order Number DE84008190.

This volume of the Building Energy Performance Standards (BEPS) Manual contains the following: implementation regulations, administrative review procedures, impact statements, and advice, consultation, and communication. (MHR)

18685 **(DOE/CS/22046—T1-Vol.3) BEPS program manual. Volume 3.** (National Inst. of Building Sciences, Washington, DC (USA)). Sep 1980. Contract FC01-80CS22046. 342p. NTIS, PC A15/MF A01; GPO Dep. Order Number DE84008191.

Two types of work schedules have been established. One is an overall element/task summary Building Energy Performance Standards (BEPS) program schedule. The other is a series of detailed subtask schedules. The overall BEPS Program Schedule is organized by subtask and the detailed subtask schedules are organized by activity and subactivity, etc. Also included in this volume are the program directory, deliverables, and budget. (MHR)

18686 **(DOE/CS/22053—T1) Centaur's support services and products for the residential conservation service program. Final report.** (Centaur Associates, Inc., Washington, DC (USA)). 31 Jul 1983. Contract AC01-80CS22053. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007863.

An annotated list of Centaur's products and services developed during the period between October 1979 and June 1983 is presented. (MHR)

18687 **(DOE/R5/10302—2) All wood briquet. Final report.** (Milltown Products, Paradise, MI (USA)). 1984. Contract FG02-81R510302. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007348.

A residue fired burner, residue being sawdust in this case, was constructed and tested with favorable results but the lack of sufficient funds prevented its development. The product, and All Wood Briquet, subsequently called the Milltown Loggett, was successfully refined and demonstrated. A business plan including financing, marketing and production has been prepared and is presently being implemented to place the Milltown Loggett into commercial production.

18688 **(DOE/R7/01029—T1) District Energy System Project. Final report.** (Union Sarah Community Corp., St. Louis, MO (USA)). 1984. Contract FG47-79R701029. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007745.

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A planned total energy system for an urban low-income community is described. The problems which plagued the project and its eventual collapse are detailed. The project plan is included. (MHR)

18689 **(DOE/R7/01100—T1) Development of a geothermal heat pump. Final report.** Amstutz, D. (Amstutz (Dean), Bloomfield, IA (USA)). 2 Nov 1981. Contract FG47-80R701100. 19p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007731.

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In the development of a geothermal heat pump a water source heat pump was connected to a 1-1/2" water line, 2200' long, buried in an endless loop 10' deep. The system is closed, circulating the same water continuously through the heat pump back to the field again. This water line 10' deep is the geothermal heat source. No matter how cold the air temperature gets on a winter day the water temperature to the heat pump will always be above 45°F. This system has efficiently heated our house the past year using no supplemental heat.

18690 **(EPRI-EM—3371) Commercial cool storage primer. Final report.** Townsend, S. (RCF, Inc., Chicago, IL (USA)). Jan 1984. 51p. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

Material for use by electric utilities desiring to inform customers and others about the basic concepts and benefits of cool storage in commercial building applications is presented. The material is presented in the form of an information brochure that describes the system components, operating modes, and associated sizing criteria for cool storage and illustrates procedures for estimating electric bill savings under several different types of rate schedules. The method of exposition is intended as a useful illustration of how a utility might design its own information material.

18691 **(ORNL/CON—100) Laboratory test of a residential low-temperature water source heat pump.** Mei, V.C. (Oak Ridge National Lab., TN (USA)). Apr 1984. Contract AC05-84OR21400. 49p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009481.

A residential unitary low-temperature water source heat pump was tested in the laboratory. Tests were performed over a broad range of source water temperatures, 7.2 to 21.1°C (45.0 to 70.0°F), and water flow rates, 3.2×10^{-4} to 8.2×10^{-4} m³/s (5 to 13 gpm). The heat pump capacity and coefficient of performance (COP) were found to be linearly related to the source water temperatures. In the heating mode, both the capacity and COP increased with increasing source water temperature and water flow rate. However, when an assumed water pumping power for a 46-m total head was taken into account in the COP calculation, the net COP for both heating and cooling decreased with increasing water flow rate. For cyclic operation over the tested source water temperature range, the coefficient of degradation, C/sub D/, ranged from 0.196 to 0.137 for heating and from 0.131 to 0.161 for cooling. The effect of inlet air humidity was also studied for cooling mode operation. A sample calculation is included to demonstrate the application of the test results in calculating the annual performance factor. The test results are used to form a data base on the performance of a typical residential unitary low-temperature water source heat pump.

18692 **(ORNL/CON—101-Vol.2) Thermal efficiency standards and codes. Volume 2. Relationships of ASHRAE standards and external factors to energy efficient building practices in new homes.** McCold, L.N.; Collins, N.E.; Zuschneid, P.B.; Hofstra, R.B. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 74p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009112.

Available data on 1976 and 1979 new home construction practices were used to develop measures of average building practice for each of the 48 contiguous states. Four possible views of the function and purpose of building energy standards and codes were posited and used to guide the search for relationships between building practice and building energy codes and standards implemented by the states. It was found that the average thermal efficiency of new single family homes improved from 1976 to 1979 in each of the 48 states. It was observed that by 1979 the average thermal efficiency of new homes in each of the 48 states exceeded American Society of Heating, Refrigerating and Air Conditioning

Engineers Standard 90-75 (ASHRAE 90). However, in all states, there were substantial numbers of new homes which did not meet the Standard. By January 1, 1979, 23 states had some type of applicable building energy code or standard in effect; 11 of these had state-wide mandatory codes. All codes and standards were either identical to or very similar to the ASHRAE Standard 90-75 in their building shell requirements. A search for statistical evidence of a relationship between state building code activities and building practice was performed. Three marginally significant relationships were found by analysis of variance; however, these relationships were not significant in regression equations with socio-economic variables present. The conclusion here is that the effects of state building code actions on building practices were not detectable by the statistical methods used.

18693 **(ORNL/CON—140) Assessment of the load management potential of the annual cycle energy system.** Kuliasha, M.A.; Poore, W.P. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 82p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84010231.

This study evaluates the load management potential of the ACES from the perspective of the electric utility. The primary objective of the study was to quantify the revenue requirements to serve an ACES-equipped house as compared with a hot water heater. Two utilities, Arkansas Power and Light Company (APL) and Duke Power Company (Duke), were selected for analysis based on climatic and utility system characteristics that appear favorable for the ACES concept. The selection criteria included five utility characteristics: load growth, reserve margin, peak season, average energy cost, and on-peak/off-peak cost differential. Four customer demographic criteria were also considered including residential growth rates, saturation of electric space conditioning, necessity for air conditioning, and ratio of heating to cooling requirement. Detailed analyses were made of generation expansion plans, system reliability, and production costs for various load growth scenarios and assumed penetrations of AECS, and the total revenue requirements were calculated for each case. The four scenarios investigated were (1) normal load growth and moderate ACES penetration; (2) normal load growth and high ACES penetration; (3) low load growth and moderate ACES penetration; and (4) low load growth and high ACES penetration. The revenue requirements developed for each of these scenarios were compared with those of a base case without any ACES involving either normal or low system load growth.

18694 **(ORNL/SUB—83-40122/1) Assessment of potential techniques for in-situ, real time moisture measurements in building envelope systems: a literature survey.** Whiting, D. (Portland Cement Association, Skokie, IL (USA). Construction Technology Labs.). 1983. Contract W-7405-ENG-26. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84007799.

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The important role which moisture plays in building envelope system performance creates a need for instrumentation capable of measuring moisture content under dynamic environmental conditions. In this survey information was compiled on the (1) range of moisture contents to be expected in various building materials, (2) moisture contents encountered in building envelopes under different field conditions, and (3) techniques available for measurement of moisture in solid materials and humidity in the atmosphere. An assessment was made of the ability of these techniques to accurately measure moisture content and humidity in components of the building envelope. Recommendations as to candidate techniques for further development and evaluation are given.

18695 **(PB—84-140862) Improving participation rates in Minnesota's residential audit program: a test marketing program.** (Minnesota Dept. of Energy and Economic Development, St. Paul (USA). Energy Div.). Oct 1983. 68p. NTIS, PC A04/MF A01.

In response to lower than anticipated requests for in-home energy audits, the Minnesota Energy Division joined Northern States Power and the Marketing Dept. of the University of Minnesota in conducting a test marketing experiment during May and June 1982. The goal of the experiment was to determine if marketing approaches other than direct mail could increase household participation in the utility sponsored Residential Conservation Service (RCS) audit program. Two delivery methods, mail and door-to-door visit by community volunteer, were used to distribute experimental marketing materials to 2,160 sampled households in 3 St. Paul area neighborhoods. Marketing materials were the standard mailed audit offer, a waterflow restrictor and two versions of a do-it-yourself home energy audit. A marketing treatment consisted of one or more of the marketing materials delivered to a residence by either of the delivery methods, direct mail or door-to-door. The impact of each treatment on audit request rates was evaluated.

3202 Transportation

REFER ALSO TO CITATION(S) 18728

18696 **(AD-A—136185/6) Preliminary design of an alternative fuels combined cycle propulsion plant for naval ship applications. Master's thesis.** Burgamy, K.S. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1981. 90p. NTIS, PC A05/MF A01.

Increasing prices and decreasing supplies of fuel oil has created a need for highly efficient ship propulsion systems capable of utilizing fuels other than oil. The purpose of this thesis is to perform a preliminary design of a combined cycle propulsion plant equipped with a multi-fuels combustor capable of burning coal or oil.

18697 **(ANL/CNSV-TM—132) Summary of railway fuel-saving options developed with industry participation.** Saricks, C.L.; Bertram, K.M.; Smith, J.W. (Argonne National Lab., IL (USA)). Jan 1984. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009083.

While government, industry, and individual rail carriers have sponsored extensive research on fuel wastage, potential alternative fuels, and energy-conserving operating techniques for the railroad industry, much of the information generated from these efforts has not been assembled into a ready-reference format covering both operational strategies and capital investment opportunities. Representatives of the railroad industry have identified a need for such a concise summary of information relating to fuel conservation in railroad freight operations. To meet this need, a matrix was developed by Argonne National Laboratory to summarize a wide variety of fuel-saving measures and their associated costs and benefits. Information was derived primarily from technical sources and manufacturers literature. This matrix was reviewed by a panel of experts from the rail industry at an industry coordination meeting in 1982 and was revised in response to their critique. In its final form, the matrix lists 38 fuel-saving measures under seven principal headings. Special emphasis is placed on well-conceived education and training programs, empty freight car miles, and elimination of unnecessary engine idling. These measures were cited by participants in the industry coordination meeting as crucial to any railroad energy-cost reduction program. The matrix has been distributed free of charge to more than 120 rail carriers in the United States.

18698 **(PB—84-124858) Adjusting highway travel forecasts for the effects of fuel shortages and price rises. Final report.** Neveu, A.J. (New York State Dept. of Transportation, Albany (USA)). Aug 1983. 105p. (R—28). NTIS, PC A06/MF A01.

Travel forecasts developed in the early 1970's do not usually consider reductions in fuel supply, increased fuel prices, or improved car efficiency. Such forecasts should be adjusted to account for recent trends in these areas. Based on a review of observed trends and previous studies of the past two energy emergencies, a set of procedures to adjust travel forecasts to reflect changes, either historical or future, in fuel supply, fuel price, and vehicle fleet fuel efficiency were developed. These procedures can be applied singly or in combinations based on a set of guidelines devised for utilizing the adjustment factors. In addition, consumer reactions to these energy events were also examined.

18699 **(PB—84-143866) Estimating vehicle fuel consumption in urban areas. Working paper.** Ferreira, L.J.A. (Leeds Univ. (UK). Inst. for Transport Studies). Jan 1981. 41p. NTIS, PC E04/MF E04.

Traffic flow simulation and assignment techniques were used to model area-wide effects of traffic management measures. Relationships between fuel consumption under urban driving conditions and the inverse of average travel speed were inferred from experimental tests. From the results a relationship which gave urban fuel consumption as a function of journey distance, total delayed time, and number of stops, was suggested for the 'average urban passenger car' in the UK. A review of reported potential fuel savings from traffic management measures was also undertaken. The effects on fuel consumption of changing the common cycle time for a coordinated system of signalised intersections were evaluated using the SATURN traffic simulation/assignment model.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 18057, 18650, 18687, 19096

18700 **(AD-A—134817/6) Improved model for a once-through counter-cross-flow waste heat recovery unit. Master's thesis.** Wesco, S.L. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1983. 196p. NTIS, PC A09/MF A01.

An improved model for a once-through counter-cross-flow waste heat recovery unit with a segmented fin-tube arrangement was developed. The model was coded in FORTRAN IV computer language for use on an IBM-3033 computer system, and was tested for various conditions of uniform and nonuniform gas flow distributions. Additional parameters varied were heat exchanger size, steam outlet pressure, steam outlet temperature and gas flow rate. The effect of each variation on WHRU performance was evaluated and the interrelationship discussed. Results indicate the ideal design is a high steam temperature, low operating pressure, flow distribution controlled heat exchanger.

18701 **(ANL/CNSV-TM—131) Projected performance of a slow-speed diesel engine and a waste-heat boiler for industrial cogeneration: preliminary analysis.** Stodolsky, F. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009131.

This report projects the performance of an industrial cogeneration facility using a slow-speed diesel engine fired with residual oil. The facility, installed in a Hoffmann La Roche chemical plant in New Jersey, became operational in December 1982. It produces 23,300 kWe, 160,000 lb/h of 225-psig process steam, and 238,800 lb/h of 170°F feedwater for existing in-plant boilers. The overall fuel utilization rate is 79.1% (gross fuel input minus losses). In 1982 dollars, an n/sup th/ installation of a similar system is expected to cost $1074/kW. The plant itself uses most of the produced power. However, the cogeneration system generates electricity in parallel with the utility and can therefore export power if desired. Diurnal and seasonal load fluctuations are expected to be minor, and the cogeneration plant is expected to achieve a capacity factor of approximately 96%. Of particular interest, and included in this analysis, are the system heat balance, derived from test-bed data and manufacturer's design criteria; an emissions evaluation; and an economic evaluation. A compilation of test results, equipment specifications, government permit data, and construction cost data form the basis of this report. Actual heat rates and operating reliability will be established in a year-long performance evaluation, which began in 1983.

18702 **(BMFT-FB-T—83-199) Hydrolysis of plastic wastes with the aim of recovering and reprocessing the starting components (recycling).** Niederdellmann, G.; Hetzel, H.; Petersen, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 183p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84750494.

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The mechanism of hydrolyzing could be transferred also to other hydrolyzable plastics, however, every plastic requires a specific optimization resulting sometimes in very expensive changes of the hydrolyzing machine. Though, main work was done in further optimization of the recycling process of flexible PUR foam, which will be the most important one with regard to the waste volume. The development of a continuous process allowed the utilization of the energy content of the hot hydrolyzate for separating it into the polyol and the main part (>90%) of TDA. Thus a considerably more economic process for separating the hydrolysate has been achieved. Regenerated polyether mixtures from unselected foam wastes of changing composition could be converted, without the necessity of being cut with high-quality pure polyether, into interesting secondary foams, which could be used in certain application areas having no high dynamic requirements (for example packaging sector, heat and sound insulation). This makes a future economical recycling process for industrial PUR foam waste feasible.

18703 **(BMFT-FB-T—83-200) Agrotherm 1976-1981. Response of a throughout the year soil-heating on soil.** Reinken, G.; Werning, L. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 122p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750491.

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The research programme "Agrotherm" means a large-scale tube system in 70 to 100 cm depth in agricultural soils to lead away industrial waste heat as a possible alternative to conventional cooling systems of power stations and industrial plants. As a consequence of warming the soil throughout the year in the soil, the following changes were stated: an increased soil temperature, a lower soil humidity in early summer, an increased release of nitrate and an increase of soil-borne pathogens (including their antagonisms). The increase of soil temperatures was significant up to a depth of 20 m. During the 6 years of research, weather conditions were very different. With some agricultural and horticultural crops remarkable yield increases were determined. Under the North-Rhine climatic conditions, the following crops may be recommended to get secure yields: early and late potatoes, grain and silage maize, sugar and fodder beets, fodder grass, red clover and most of the vegetable crops investigated. If considering the changed growing conditions, the cooling system "Agrotherm" proved to be practicable from the agricultural viewpoint.

18704 **(DOE/CE—0015/2) Annual report to Congress and the President on 1981 industrial energy efficiency improvement.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Industrial Programs). 1984. 86p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84007941.

Industrial energy efficiency improvement in 1981, introduction to the industry-specific reports, and progress in the utilization of recovered materials are discussed. Industry-specific reports are included on: food and related products; tobacco products; textile mill products; lumber and wood products; paper and allied products; printing and publishing; chemicals and allied products; petroleum and coal products; rubber and miscellaneous plastics; stove, clay, and glass products; primary metal industries; fabricated metal products; machinery, except electrical; electric and electronic equipment; transportation equipment; instruments and related products; and miscellaneous manufacturers. (MHR)

18705 **(DOE/CS/40005—T5) Brayton-cycle solvent recovery system. Phase II. System design.** (AiResearch Mfg. Co., Torrance, CA (USA)). 23 Nov 1982. Contract AC07-78CS40005. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE84007475.

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The Brayton-cycle system described in this report was designed to recover the solvents evaporated in a 3M Company magnetic tape production facility. The major solvents utilized are MEK and toluene. The system was designed to receive the warm solvent/air mixture from the drying oven, remove the solvents by condensation, and return the warm air to the oven in a recirculating system. At the heart of the Brayton-cycle system approach is a newly designed electric-motor-driven turbocompressor. The turbine/compressor shaft is designed to operate at 16,500 rpm through single-stage helical step-up gears driven by a 3550-rpm 500-hp rated

motor. The compressor is designed for a pressure ratio of 2.4 and the turbine for 2.25. The turbine/compressor and step-up gears are integrally designed for mounting to a framework with the motor. The assembly contains a lubrication system with redundant oil pumps and a water-cooled lube oil cooler. Instrumentation consists of shaft proximity probes, oil and bearing temperature sensors, accelerometers, and oil pressure transducers for controlling and monitoring system operation. Economic analysis shows that a simple payback for a similar magnetic tape installation is 1.9 yr - somewhat on the high side due to a high percentage of operation at reduced solvent evaporation rates. Paybacks of less than 1 yr are possible when operating at higher solvent concentrations and at approximately 2/3 of the available time (6000 h/yr).

18706 **(DOE/CS/40028—T2) Use of stack air to conserve energy in cupolas. Final report.** Draper, A.B. (Pennsylvania State Univ., University Park (USA). Center for Air Environment Studies). Jun 1983. Contract AC02-76CS40028. 54p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE83014729.

The Field Demonstration of the Stack Air Project had four objectives which can be stated as follows: develop and demonstrate a safe and economically viable Stack Air system which could avoid the need for a conventional after burner; document the energy savings from eliminating afterburner(s); establish the impact of afterburst elimination on the environment and on the safe operation of a gray iron foundry; and transfer the technology from a university research cupola to at least two commercial melting operations in order to pave the way for further technology transfer to the foundry industry. This report deals with these four objectives. It includes the findings obtained from Tioga Foundry in Owego, New York using a 42 inch cupola and those from ABEX Foundry in Meadowlands, PA using a 54 inch cupola. Later an environmental impact study was carried out at the Tioga Casting Facility.

18707 **(DOE/ID/12439—T1) New concept in grinding for energy efficiency.** Karra, V.K. (Rexnord, Inc., Milwaukee, WI (USA). Process Machinery Div.). 1984. Contract FC07-83ID12439. 34p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008196.

The objective was to assess the potential energy savings of a laboratory-scale, conveyor-belt-type autogenous (new-concept) mill and compare its performance to a 5.5-ft diameter conventional autogenous mill. The project included provisions for the design, construction, and field testing of a pilot-scale, new-concept mill and technology transfer activities. Comparative tests with the laboratory-scale, new-concept and conventional mills, using taconite ore, revealed the new-concept mill as inefficient in terms of process and mechanical energy requirements.

18708 **(DOE/R7/01034—T1) Fiberoptic home lighting.** Keleher, D. (Keleher (Dan), Sibley, MO (USA)). 1982. Contract FG47-79R701034. 13p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007743.

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Initial effort on this grant project was to construct a model that would demonstrate the feasibility of various lighting theories. Testing of suitable materials for utilization as fibreoptic components was the second priority. The material chosen for the project was 5/8 inch diameter plexiglas rod. The next step involved determining the limitations and other properties of the plexiglas rod. The final factor in developing a useable system involved testing different types and colors of light and their ability to be transmitted by the optic fibre. The culmination of the research and testing resulted in the demonstration projects.

18709 **(NP—4770163) Electricity demand and energy consumption in horticulture and conclusions bearing on energy economy.** (Arbeitsgemeinschaft fuer Elektrizitaetsanwendung in der Landwirtschaft e.V., Essen (Germany, F.R.)). 1980. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84770163.

The studies demonstrate that horticultural entreprises, esp. those with a higher electricity consumption, have often not settled for a more favourable electricity tariff. Nor do they use cheaper electricity at slack periods (night current) to the extent possible. Substantial improvement could be obtained above all by fully utilizing the installed capacity through purposeful utilization of machinery and interlocking of major consumers. Measures appropriate to this end are listed allowing a possible economic utilization of electric energy.

18710 **(NP—4770171) Correlation between experimentally determined properties of state and a fundamental equation for electrolytic methanol solutions used as working fluids for absorption heat pumps.** Eichholz, H.D. (Deutscher Kaelte- und Klimatechnischer Verein e.V., Stuttgart (Germany, F.R.); Dortmund Univ. (Germany, F.R.). Abt. Chemietechnik). 26 Oct 1982. 167p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770171.

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The suitability of electrolytic, methyl alcohol salt mixture phases as working media in absorption heat pumps is deduced from evaluation criteria for mass systems. The binary mixture of methanol and lithium bromide is taken as starting point, although the rheological properties of this mixture cannot be considered optimal for the absorption heat pump process. The inclusion of a further component, namely zinc bromide, leads to more favourable behaviour. In this dissertation the available properties of state for mixtures of methanol/lithium bromide, methanol/zinc bromide, and the ternary mixture methanol/2 mol lithium bromide/1 mol zinc bromide are supplemented by measurement of phase equilibrium data and isothermal enthalpy of mixing. The determination of caloric properties of state is of major importance since these form the basis of an enthalpic balance of processes.

18711 **(PB—84-127141) Recovery, reuse, and recycle of industrial waste.** Noll, K.E.; Haas, C.N.; Schmidt, C.; Kodukula, P. (Illinois Inst. of Tech., Chicago (USA)). Nov 1983. 217p. NTIS, PC A10/MF A01.

The major goal of this work is to produce a document useful in planning efforts aimed at elimination of industrial wastes through the application of recycle, recovery, and reuse technology. The pollutants considered in this study are basically organic and inorganic by-products from wastewater effluents, solid residue and gaseous emissions from industrial operations. The first section contains chapters on methodology currently available for recovery of industrial and hazardous waste, and developing technology for recycle, reuse and recovery. The second section contains chapters on 5 technical categories, used for recovery namely, sorption, molecular separation, phase transition, chemical modification, and physical dispersion and separation.

18712 **(PB—84-131960) Remoulding the future: the plastics and other recycling industries. Alternative industrial framework report No. 5.** Bollard, A.E.; Vogler, J.A. (Intermediate Technology Development Group, London (UK)). 1984. 48p. NTIS, MF$4.75.

This report is a comprehensive study of recycling industries in the United Kingdom. It discusses different types of recycling including the reuse of the object, reuse of the material, reclamation of the material and conversion of the material. The materials discussed are ferrous and nonferrous metals, paper, glass, textiles, chemicals, and other organic and inorganic wastes. The recycling operation is detailed including collection, separation, processing, and fabricating. Private industry, government, and voluntary organization activities are considered as is the promotion and implications of increased recycling. Part two of this report studies the relatively new and rapidly growing plastics recycling industry. It covers using process wastes and post-consumer wastes as material, the pressures to recycle, recycling operations (collection separation, reprocessing, marketing, and mixed plastics wastes), and the organization of the plastics recycling industry in private, public, and voluntary organizations. (Copyright (c) Intermediate Technology Development Group, 1982.)

18713 **(PB—84-134774) Quality, energy saving production and fire resistance concrete structures.** (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Betoni- ja Silikaattitekniikan Lab.). 1984. 154p. NTIS, PC AE08/MF E01.

The quality of concrete structures, both in the field of load bearing frames and nonbearing elements as, for example facades, also requires structural development work. For use of waste materials, such as blast furnace slag, both the material properties and the production methods are studied. To increase the knowledge on the fire resistance of concrete structures the material properties at elevated and high temperatures are presented in the lectures as well as the behavior of structures subjected to fire.

18714 **(PNL—4883) Industrial fouling: problem characterization, economic assessment, and review of prevention, mitigation, and accommodation techniques.** Garrett-Price, B.A.; Smith, S.A.; Watts, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 277p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84008359.

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A comprehensive overview of heat exchanger fouling in the manufacturing industries is provided. Specifically, this overview addresses: the characteristics of industrial fouling problems; the mitigation and accommodation techniques currently used by industry; and the types and magnitude of costs associated with industrial fouling. A detailed review of the fouling problems, costs and mitigation techniques is provided for the food, textile, pulp and paper, chemical, petroleum, cement, glass and primary metals industries.

18715 **Design of resilient processing plants. II. Design and control of energy management systems.** Marselle, D.F.; Morari, M.; Rudd, D.F. (Univ. of Wisconsin, Madison). *Chemical Engineering Science;* **37**: No. 2, 259-270(1982). Contract AC02-80ER10645.

The standard heat exchanger network problem has been surprisingly difficult to solve. It is only now that simple and reliable methods have evolved to synthesize the most efficient network of heat exchangers to heat and cool known process streams between stated temperature bounds. This has taken over a decade of research and scores of publications. The resilient heat exchanger network problem requires a solution that can cope with the uncertainties of industrial design. Fixed flow rates and temperature bounds rarely occur industrially. Rather, an industrial heat exchanger network problem necessarily involves ranges of flow rates and ranges of temperature bounds, and must include ease of operation and control. In this paper several fundamental advances are made in the design of resilient heat exchanger networks: (1) an efficient design procedure is developed to yield resilient designs which handle fluctuation within the condition of maximum energy efficiency; and (2) a control structure and operating policy are developed to adjust flow distributions in the network to meet temperature constraints with minimum utility usage. These developments are based on several new theorems concerning resiliency in network design. 18 references, 7 figures, 4 tables.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 18304, 18693

18716 **(BMFT-FB-T—83-221) Utilization of sewage gas for integrated generation of electricity and heat, at the sewage treatment plant of the city of Oldenburg as an example.** Steinborn, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1983. 270p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84750501.

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Using the central sewage treatment plant of the city of Oldenburg as an example, the possibility of employing sewage gas for integrated generation of electricity and heat has been investigated. In addition, the extent to which the results can be employed in other sewage treatment plants in the Federal Republic of Germany has also been analyzed. On base of mass and energy balances various systems for utilizing sewage gas have been studied considering the incorporation of the sewage treatment plant into the public energy supply systems. The general transferability of the results to sewage treatment plants has been studied considering published statistics and own investigations. System combinations for utilizing sewage gas have been found which still have to be optimized for spezial application.

18717 **(DOE/CS/20071—1-Vol.4) District heating and cooling systems for communities through power plant retrofit distribution network. Phase 2. Final report, March 1, 1980-January 31, 1984. Volume IV.** (Public Service Electric and Gas Co., Newark, NJ (USA)). 31 Jan 1984. Contract AC02-78CS20071. 265p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84006861.

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This volume contains the following: discussion of cost estimating methodology, detailed cost estimates of Hudson No. 2 retrofit, intermediate thermal plant (Kearny No. 12) and local heater plants; transmission and distribution cost estimate; landfill gas cost estimate; staged development scenarios; economic evaluation; fuel use impact; air quality impact; and alternatives to district heating.

18718 **(DOE/CS/20071—1-Vol.7-App.C) District heating and cooling systems for communities through power plant retrofit distribution network. Phase 2. Final report, 1 March 1980-31 January 1984. Volume VII. Appendix C.** (Public Service Electric and Gas Co., Newark, NJ (USA)). 31 Jan 1984. Contract AC02-78CS20071. 149p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84006862.

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This volume contains: Hudson No. 2 Limited Retrofit Cost Estimates provided by Stone & Webster Engineering Corp. (SWEC); backup data and basis of estimate for SWEC Heater Plant and Gas Turbine Plant (Kearny No. 12) cost estimates; and Appendices - Analysis of Relevant Tax Laws.

18719 **(DOE/CS/20291—T2) Development of the utilization of combustible gas produced in existing sanitary landfills. Investigation of effects of air inclusion.** (Pacific Gas and Electric Co., San Francisco, CA (USA)). 30 Apr 1981. Contract FG01-79CS20291. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007873.

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A combustible gas mixture composed of methane and carbon dioxide is generated in municipal solid waste landfills. A practical consequence of the collection of this fuel gas is the inclusion of some air in the collected product. This report discusses the effects of such included nitrogen and oxygen on landfill gas operations. The effects include increased collection and purification costs, reduction in the quality of the fuel gas produced, corrosion, explosion hazards, and interference with odorant systems. The scope of such effects was determined using data and experience from the Mountain View, California, landfill gas recovery site as a basis. Useful supplemental fuel gas may be recovered despite the inclusion of air. Recommendations are given for establishing limits for nitrogen and oxygen content and minimizing the costs associated with their presence.

18720 **(DOE/CS/20291—T3) Development of the utilization of combustible gas produced in existing sanitary landfills. Effects of corrosion at the Mountain View, CA Landfill Gas Recovery Plant.** (Pacific Gas and Electric Co., San Francisco, CA (USA)). 30 Apr 1981. Contract FG01-79CS20291. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007872.

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Corrosion of equipment has occurred at the Mountain View, California Landfill Gas Recovery Plant. Corrosion is most severe on compressor valve seats and cages, tubes in the first and second stages of the interstage gas cooler, and first and second stage piping and liquid separators. Corrosion occurs because the raw landfill gas contains water, carbon dioxide, and oxygen. Some corrosion may also result from trace concentrations of organic acids present in the landfill gas. Corrosion of the third stage compressor, cooler, and piping does not occur because the gas is dehydrated immediately prior to the third stage. Controlling corrosion is necessary to maintain the mechanical integrity of the plant and to keep the cost of the gas competitive with natural gas. Attempts to reduce corrosion

rated by injecting a chemical inhibitor have proved only partially successful. Recommendations for dealing with corrosion include earlier dehydration of the gas, selection of special alloys in critical locations, chemical inhibition, and regular plant inspections.

18721 **(DOE/CS/20291—T4) Trace chemical characterization of pollutants occurring in the production of landfill gas from the shoreline regional park sanitary landfill, Mountain View, California.** Flynn, N.W.; Guttman, M.; Hahn, J.; Payne, J.R. (Science Applications, Inc., La Jolla, CA (USA)). Apr 1981. Contract FG01-79CS20291. 105p. NTIS, PC A06; 3; GPO Dep. Order Number DE84007868.

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This report summarizes the results of sampling and analysis of ambient and process gas streams, and liquid and solid samples taken at different locations from the Pacific Gas and Electric Company Landfill Gas Recovery Plant in Mountain View, California. The purpose of this study is to identify environmental pollutants and characterize the trace chemistry of landfill gas recovered from the Mountain View Sanitary (Class II) Landfill. Gaseous samples, liquid condensate and other plant products were analyzed for their trace chemical constituents, and the results indicate that certain organic and inorganic pollutants inherent to the landfill are emitted into the ambient environment and also become involved in the methane recovery process. Incorporation of condensate traps, molecular seive and charcoal filtration was found to significantly reduce both the organic and inorganic component burdens in the product gas. The environmental significances of the landfill gas recovery to the surrounding area and to worker safety are presented.

18722 **(DOE/CS/20291—T5) Development of the utilization of combustible gas produced in existing sanitary landfills: evaluation of the use of carbon dioxide produced in sanitary landfills.** Ashare, E.; Sharon, A.C.; Moschini, L.R. (Pacific Gas and Electric Co., San Francisco, CA (USA)). 6 Feb 1981. Contract FG01-79CS20291. 68p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007874.

This report is a survey of the potential markets for carbon dioxide derived from the purification of landfill gas into 1) a methane rich stream which can be used as a high Btu (950/SCF) fuel gas, and (2) a carbon dioxide-rich stream. Interviews with individuals in the CO_2 industry have revealed the potential markets for CO_2, gas purities required for different applications, and wholesale prices for CO_2. A review of the technology for landfill gas purification has been included, and various processes have been matched to the CO_2 markets based on the composition of the CO_2 rich effluent stream. Estimates of the capital, operating, and unit gas costs for the various purification processes and energy balances for the several processes are included. It is recommended that detailed economic and market analyses be performed for individual landfill sites, in order to identify the markets, if any, for CO_2 near the landfills, determine the purification processes which will yield CO_2 of sufficient purity for these applications, and to select the market and purification techniques which will produce the lowest unit gas cost for fuel gas from landfills.

18723 **(DOE/R7/01125—T1) Street light load study. Final quarterly report.** (Kansas City, City of, MO (USA). Public Works Dept.). Oct 1981. Contract FG47-80R701125. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007713.

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In the category of electric utility customers - Municipal Street Lighting, there is an increasing need to properly assign costs to this operation. It is probable that the utility assigned annual burning time (hrs) for street light billing is arbitrary and as such has some weight of faulty tradition. Kansas City, MO, as intervenor in utility rate matters before the Public Service Commission of Missouri, has been increasingly concerned with the rate increase assigned to street lights. For example, the street light bill for Kansas City, MO, has increased from less than two million dollars to approximately six million dollars within a short time frame. The data collected during this project activity should contribute to a more improved costing concept for street lights throughout the US to the mutual benefit of the utility and to the street light customer.

18724 **(ORNL/TM—8927) Steam/hot water district heating evaluation at the Oak Ridge National Laboratory Site.** Karnitz, M.A.; McLain, H.A.; Barnes, M.H.; Murphy, G.V.; McCold, L.N.; Lindell, M.C. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract AC05-84OR21400. 152p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84009479.

The Oak Ridge National Laboratory site has a steam district heating system that was installed in the early 1940's. A large portion of the steam distribution system is buried, and recently there have been failures in the buried pipelines. This investigation compares the economics of renovating the existing east-end steam system with the economics of replacing this portion with a new hot water system. A decision must be made on the future of this portion of the system since it can no longer be considered reliable. Renovation of the east-end portion of the steam system would include replacement of approximately 6000 ft of pipe and is estimated to cost $4,160,000. It is anticipated that renovation to the east-end system would reduce the annual fuel bill by about 15% and cut maintenance costs. The new hot water system option would include installing 15,000 ft of buried piping at the east end of the plant. It would also include converting the buildings to be compatible with a new hot water system. This option would cost about $3,000,000 more than the steam renovation option; however, the hot water option has an annual savings in fuel and maintenance of about $665,000 over the steam renovation. The simple payback for the hot water option is 4.5 years. The hot water option is attractive, and it is recommended that the development of this system be pursued.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 18697

18725 **(DOE/AD/11261—T1) Race, income and energy conservation. Final report.** McMurry, M.M.; Beady, C.H. Jr.; Isuk, E.E.; Amin, R. (Morgan State Univ., Baltimore, MD (USA). Inst. for Urban Research). 1982. Contract FG01-81AD11261. 123p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84005711.

The purpose of this project was to study attitudes and behaviors primarily of low income and minority black and white Baltimore (MD) residents concerning energy conservation and related social concerns. A door-to-door survey was conducted in which randomly sampled heads of households were interviewed. The data were collected by trained interviewers and analyzed using the chi-square (X^2) test for statistical association. Our results show some similarities but also many race related, income related and income by race related differences regarding attitudes and behaviors toward the conservation of energy. This project identified the following needs: (1) more education to increase awareness of existing energy conservation and related programs, (1) continuation of existing programs with some adjustments, and (3) increased local input in program implementation. Our results also support the recommendation that some co-ordination be established among various fuel assistance and energy conservation programs, to increase efficiency, lower costs, increase public awareness and ultimately program participation.

18726 **(DOE/R7/01035—T1) Missouri friends of the earth county energy project. Final report.** Johnson, S.H.; Pierce, D. (Missouri Friends of the Earth, Columbia (USA)). 1979. Contract FG47-79R701035. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007740.

The goal of the grant was to promote the development of community energy planning for energy conservation and renewable energy resources in Missouri. This goal was promoted through the development of five (5) separate objectives: (1) appropriate technology conference; (2) demonstration models; (3) slide show and display board; (4) newsletter; and (5) resource library. These objectives were carried out and we feel have successfully raised the awarness among Missourians about energy conservation and renewable resources. A brief summary of the five specific objectives is presented.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 18770

18727 (DOE/ER/10646—3) Topics in finite time thermodynamics. (Chicago Univ., IL (USA). Dept. of Chemistry). 1984. Contract AC02-80ER10646. 11p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009057.

The year 1983-1984 continued to be very productive for this project on finite-time thermodynamics. The scientific topics of principal concern have been: principles of optimized heat engines; availability and dissipation for finite-time systems; finite-time processes doing chemical work; and zero-work controls of energy-using systems.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 18633

18728 (AD-A—136201/1) Electric remotely piloted vehicle (ERPV). Final, August 1980-August 1982. Smith, J.O. (Sundstrand Corp., Rockford, IL (USA). Sundstrand Aviation Mechanial Unit). Sep 1983. 156p. NTIS, PC A08/MF A01.

Electric propulsion offers significant advantages over the present gasoline engine propulsion system on a Remotely Piloted Vehicle (RPV). The advantages are the result of technical advances in batteries, power transistors, permanent magnets and control methods. This report covers the ground and flight test of an RPV using a lithium thionyl chloride battery powering a samarium cobalt brushless DC Motor.

18729 (CONF-831272—1) System/battery design interaction for a lithium-metal sulfide van battery. Chilenskas, A.A. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 22p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007274.

From EHV systems assessment seminar; Gainesville, FL, USA (14 Dec 1983).

A conceptual van battery design based upon system inputs from the Chrysler T-Van Project and an ANL/Toyota Study has been completed. A van battery consisting of 162 Li-Alloy/FeS cells would meet the requirements for range, acceleration, and payload specified by EPRI. Considerable engineering work remains in developing reliable battery modules and battery components for such a battery. A van battery program, funded by EPRI and supported by DOE studies, has been initiated.

18730 (CONF-840390—1) Use of the Li-Al/FeS battery in advanced vehicle propulsion systems. Chilenskas, A.A.; Yao, N.P. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007275.

From Vehicle propulsion symposium; Indianapolis, IN, USA (20 Mar 1984).

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The lithium/molten salt system provides for a family of batteries with lithium as the electrochemically active element and a molten salt mixture containing lithium as the electrolyte. The basic concept of the Li-Al/FeS battery is given, and its status is compared to aqueous batteries and other advanced couples. Research work on more energetic couples such as Li-Si, FeS_2 and pure lithium is underway as well as Li-Al. Ongoing programs are summarized, one of which involves an electrified Chrysler T-van that uses a Li-Al/FeS battery. (LEW)

18731 (DOE/CS/54273—T1) Comcar field test and demonstration project. Final report. Jenkins, P.E. (Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering). 24 Jan 1983. Contract FG01-78CS54273. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84004663.

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Operating experience with the Jet Industries EV-600, electric van is reviewed. Maintenance problems are listed. (MHR)

18732 (DOE/ER/52065—T1) Comparison of alternative energy storage systems for automobiles. (National Academy of Sciences, Washington, DC (USA)). 1982. Contract AI01-80ER52065;AT01-76CS93012. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007425.

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This report outlines a number of areas of research that are recommended for attention (in addition to areas of basic research in support of the more promising rechargeable batteries) as part of a well-rounded investigation of internal combustion engine alternatives. Specifically, the following recommendations are made: electrolytes and novel electrode structures should be investigated for lithium/sulfur batteries, and secondary lithium/sulfur dioxide cells should receive research attention; cost and life problems of air electrodes for aluminum-air batteries should be studied, together with the potential impacts of large numbers of aluminum-air powered cars on the aluminum industry infrastructure. Existing research on aluminum-air batteries might be expanded following such studies; improved materials for phosphoric acid fuel cell structures should be identified through research, as should electrolytes to improve the system start-up times and responses; and systems studies and fuel acceptability analyses for alkaline fuel cells should be conducted, and research should be directed to the solution of air electrode cost and life problems, ongoing flywheel R and D programs should be continued, but with added emphasis on continuously variable transmissions and on overall flywheel-transmission system designs.

18733 (UCRL—90468) Estimate of the consumer cost of aluminum fuel for electric vehicles. Cooper, J.F. (Lawrence Livermore National Lab., CA (USA)). 22 Feb 1984. Contract W-7405-ENG-48. 17p. (CONF-8205249—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008327.

From 2. international workshop on reactive metal-air batteries; Palo Alto, CA, USA (1 May 1982).

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The cost of aluminum fuel to the vehicle owner is estimated in view of technical developments and price increases in aluminum ingot since 1979. The estimate is based on the US Industry Published Price for distributed 50-lb ingot. This price is then increased by the costs of fabrication, alloying agents, premium purity, and service station (retail) markups derived by analogy to gasoline. A credit for recycled hydrargillite is also estimated, although actual return is speculative. A critical assumption is the energy yield of the aluminum, as measured by the vehicular fuel efficiency. For vehicular fuel efficiencies to 36 to 42 gross tonne-km/kg-Al, fuel costs are equivalent to liquid fuel costing $0.56 to 0.94/liter ($2.12 to $3.54/gal) (mid-1981 US dollars) used in advanced automobiles with fuel efficiencies of 13.5 to 19.3 gross-tonne-km/l (35 to 50 gross-ton-miles/gal-fuel). The current distribution system for aluminum is briefly described, and the retail markups for gasoline are tabulated. These results do not differ substantially from those of an earlier study when costs are expressed in constant dollars.

3305 Flywheel Propulsion

REFER ALSO TO CITATION(S) 18732

3306 Vehicle Design Factors

18734 (CONF-800202—4) Brazilian experience with self-adjusting fuel system for variable alcohol-gasoline blends. Leshner, M.D.; Luengo, C.A.; Calandra, F. (Fuel Injection Development Corp., Cherry Hill, NJ (USA); Universidade Estadual de Campinas (Brazil). Inst. de Fisica; Bendix do Brazil Ltd.). 1980. Contract FG01-80CS15022. 11p. Society of Automotive Engineers, Inc., 400 Commonwealth Dr., Warrendale, PA 15096.

From SAE automotive engineering congress and exposition; Detroit, MI, USA (25 Feb 1980).

A fuel control system has been developed which allows fuels of various stoichiometries to be used interchangeably without suffering a fuel consumption penalty, allowing a more efficient use of the combustion energy. This Adaptive Lean Limit Control system uses a single, digital sensor and an electronic circuit to detect lean limit engine operation, and feeds back information to the fuel system to maintain the best economy mixture, regardless of the fuel blend being used. The hardware is described, and the results of extensive vehicle testing, using 20% and 50% ethanol-gasoline blends, are included.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 18046, 18078, 18696

36 MATERIALS

REFER ALSO TO CITATION(S) 18496, 18499, 18501, 18818

18735 (UCRL—90138) Ultrasonic machining (impact grinding). Rutan, H.L. (Lawrence Livermore National Lab., CA (USA)). 28 Feb 1984. Contract W-7405-ENG-48. 7p. (CONF-840494—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007733.

From Topical meeting on optical fabrication and testing; Monterey, CA, USA (18 Apr 1984).

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This presentation describes ultrasonic machining (impact grinding) of hard brittle materials in general and its use in optics at LLNL.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 17918, 17933, 17934, 18138, 18139, 18175, 18436, 18497, 18498, 18500, 18508, 19001

18736 (AD-A—134910/9) Superconductivity in hydrogen-charged ion-beam mixed palladium copper alloy. Technical report. Scholz, W.; Leiberich, A.; Standish, W.J.; Homan, C.G. (Army Armament Research and Development Command, Watervliet, NY (USA). Large Caliber Weapon Systems Lab.). Jun 1983. 21p. (ARLCB-TR—83026). NTIS, PC A02/MF A01.

Superconducting PdxCu(1-x)(H) has been made by ion-beam mixing and low-temperature electrolysis. A multi-layered sample consisting of alternate layers of Cu and Pd, sputter-deposited onto a Pd foil substrate, was bombarded with 125 KeV Xe+ ions. Analysis by Rutherford backscattering (RBS) showed the formation of a Pd.6Cu.4 alloy region approximately 38 micrograms/sq cm thick. After electrolytic charging with H at dry ice temperature, superconductivity was observed, with a transition temperature, Tc, of 11.4 K in the alloy region. The effects of increased currents and changes in the H distribution due to annealing between 77 k and 85 C on the transition curves have been investigated. Transition curves produced in this fashion are broad with an onset of the superconducting transition as high as 14 K. The sample remains partially superconducting even after overnight anneal at room temperature. Electrolysis at room temperature also produces superconducting transitions with onsets as high as 17 K.

18737 (AD-A—136156/7) Elastic properties of uranium - .78 titanium as a function of pressure to 1.6 GPa. Final report. Frankel, J.; Dandekar, D. (Army Armament Research and Development Command, Watervliet, NY (USA). Large Caliber Weapon Systems Lab.). Oct 1983. 18p. (ARLCB-TR—83038). NTIS, PC A02/MF A01.

The transit time for passage of longitudinal and shear ultrasonic waves through polycrystalline depleted uranium - .78 weight percent titanium (Ti) alloy was determined as a function of pressure in a hydrostatic medium. Specimens of two thicknesses were used in order to eliminate bond-transducer effects from transit time determinations. The longitudinal velocity vL increases 3.5 pecent from one atmosphere to a value of 3.48 km/sec at 1.6 GPa; the shear velocity vs increases 5 percent to 2.08 km/sec; the adiabatic bulk modulus Bs increases 8.1 percent to a value of 120 GPa and the shear modulus u, 9.4 percent to 81 GPa over the same pressure range.

18738 (CONF-840218—5) Dislocation shielding model of fracture toughness. Ohr, S.M.; Chang, S.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007539.

From 113. annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers; Los Angeles, CA, USA (26 Feb 1984).

A recently developed dislocation model of fracture has shown that fracture toughness of a material depends directly on the number of dislocations in the plastic zone. The model is based on TEM observations that there is a dislocation-free zone between the crack tip and the plastic zone and the crack tip is shielded from the applied stress by the dislocations in the plastic zone. Elasticity is restored in the region immediately ahead of the crack tip and hence it is possible to define a crack tip stress intensity factor. In the present paper, a review is given of the dislocation-free zone model of fracture and the concept of dislocation shielding of a crack tip. An expression for the fracture toughness of a material is derived from the model in terms of the parameters describing the crack tip geometry. A criterion for ductile vs brittle fracture is proposed in terms of the condition for crack tip deformation.

18739 (CONF-840263—1-Draft) Neutron scattering in magnetic fields. Koehler, W.C. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007541.

From Workshop on samples environments in neutron and x-ray experiments; Grenoble, France (13 Feb 1984).

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The use of magnetic fields in neutron scattering experimentation is reviewed briefly. Two general areas of application can be distinguished. In one the field acts to change the properties of the scattering sample; in the second the field acts on the neutron itself. Several examples are discussed. Precautions necessary for high precision polarized beam measurements are reviewed. 33 references.

18740 (GKSS—82/E/54) Fracture mechanical test methods of irradiated pressure vessel steels. Hebenbrock, H.D.; Schmitt, F.J.; Spalthoff, W. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 36p. (In German). (CONF-8206149—5). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750518.

From 21. Euratom workshop on hot laboratories and remote handling; Mol, Belgium (10 Jun 1982).

After a short introduction into the method of safety analysis of reactor pressure vessels the technics for determination of the irradiation effect on the ductility of pressure vessel steels are described, which are in use in the hot laboratory of the GKSS research centre. The steel specimens irradiated in the research reactor FRG-2 or a power reactor are tested in remote-handled machines shielded with lead. The Pellini drop weight test, the impact test and

the fracture mechanic tests for determination of the fracture toughness Ksub(Ic) and the critical J-integral Jsub(Ic) are described.

18741 **(INIS-mf—8360) Superconducting electron tunneling as detection method for low frequency resonant vibration modes of interstitials in fcc lead.** Adrian, H. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Naturwissenschaftliche Fakultaet 1 - Mathematik und Physik). 26 May 1981. 123p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780106.

The influence of crystal defects on the phonon spectra was studied for fcc lead using superconducting tunneling spectroscopy. The theory predicts low frequency modes for the vibrational states of interstitials in (100) dumbbell configuration. Low temperature irradiation of superconducting point contacts with fast ions (point contact thickness small compared to the average ion range) showed radiation-induced structures in the low-energy part of the Eliashberg function for lead. These resonant modes are reduced by annealing at 18.5 K; they are attributed to small interstitial clusters. The radiation-induced structures are completely removed by room temperature annealing.

18742 **(INIS-mf—8361) Pressure and temperature dependence of the magnetic susceptibility intermediate valence Ce and Yb compounds.** Zell, W. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 27 Jun 1981. 94p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84780107.

The magnetic susceptibility of 13 intermediate valence Ce and Yb compounds was studied at room temperature as a function of pressure. Low temperature measurements showed a pressure induced shift of the susceptibility maximum for $YbInAu_2$ and Ce(Rhsub(0.7) Ptsub(0.3))$_3$. A general relationship between the pressure dependent activation energy and the fluctuation temperature is supposed for Yb compounds. The relative pressure dependence of the susceptibility has a maximum at the intermediate valence 2.5 and is decreasing toward integer valences.

18743 (INIS-mf—8703, pp vp) **Neutron diffraction topography of iron single crystals.** Chalupa, B.; Vrana, M. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

18744 (INIS-SU—197, pp 59-62) **Changing of the metal properties by the helium implantation.** Khudyakov, A.V.; Khudyakov, V.A. (AN SSSR, Vladivostok. Inst. Khimii). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

A principal possibility of obtaining high non-equilibrium contents of helium in the state of substitution is predicted on the basis of analysis of theoretical and experimental data of different authors. Decrease of cohesive energy, temperatures and pressures of phase transformations is forecasted. A probability of a helium-vacancy (HeV) complex dissociation is higher than its migration. After HeV decomposition helium finds the outlet over interstitials quicker than vacancy, that is why material migration in non-equilibrium vacancies is possible under heating. It should result in essential increase of diffusion mobility of intrinsic and impurity atoms. Electrons with energy above 10 keV can destroy helium-vacancy complexes.

18745 (INIS-SU—197, pp 40-43) **Influence of dislocation loops evolution on the radiation growth of diffusion-anisotropic crystals.** Kiryukhin, N.M. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

The effect of diffusion anisotropy on loop evolution of vacancy-type dislocations in crystals under radiation is investigated within the frames of diffusion-dislocation theory. Expressions for the rate of radiation growth with account for production of vacancy loops in cascades, growth rate of these loops, stationary function of dimensional loop distribution are obtained. Some experimentally observed regularities of V and Zr radiation growth are qualitatively analyzed on the basis of the obtained expressions.

18746 (INIS-SU—198, pp vp) **Hyperfine magnetic field on ^{181}Ta v YFe_2.** Aksel'rod, Z.Z.; Budzynski, M.; Komissarova, B.A.; Kryukova, L.N.; Ryasnyj, G.K.; Sorokin, A.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18747 (INIS-SU—198, pp vp) **Moessbauer spectroscopy of nuclear reaction after effects in Ni_3Fe, Ni_3Cu, Ni_3Mn.** Ibragimov, Sh.Sh.; Zhetbaev, A.K.; Vereshchak, M.F.; Zhantikin, T.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18748 (INIS-SU—198, pp vp) **Nuclear magnetic resonance of oriented nuclei of sup(56,57,60)Co in Fe matrix.** Chizhek, P.; Ehnglikh, I.; Finger, M.; Malinski, P.; Rotter, M.; Sedlak, B. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18749 (INIS-SU—198, pp vp) **Temeperature dependence of the hyperfine field on sup(119)Sn in Gd.** Rejman, S.I.; Rokhlov, N.I.; Shpinel, V.S.; Gor'kov, V.P.; Chechina, A.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

NONE

18750 (INIS-SU—198, pp VP) **Hyperfine magnetic fields on ^{172}Yb in Fe and Ni.** Budzynski, M.; Kochetov, O.I.; Lebedev, N.A.; Morozov, V.A.; Muminov, A.I.; Salamatin, A.V.; Subotovich, M.; Yushkevich, Yu.V. 1983. (IN RUSSIAN). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18751 **(IS-T—1109) Thermotransport of hydrogen in niobium and tantalum as a function of hydrogen concentration.** Kim, S.J. (Ames Lab., IA (USA)). Jan 1984. Contract W-7405-ENG-82. 46p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007370.

Thesis.

Transport of hydrogen in Nb and Ta has been measured in an extended hydrogen concentration range up to 0.3 [H/M] atomic ratio. In these high concentrations where the activity coefficient is not constant with concentration, the heat of transport is defined based on an activity ratio. Using the square root of the hydrogen pressure versus hydrogen concentration curves extrapolated from the curves measured by Veleckis and Edwards, the activity ratios were calculated from the measured concentrations. The absolute thermoelectric power of Nb and Ta has been measured in the same hydrogen concentration range in order to check the relationship, which was predicted by Huntington, between the absolute thermoelectric power and the heat of transport. The heat of transport based on the activity ratio, Q*(a/sub H//a/sub C/), decreased as the hydrogen concentration increased in both Nb and Ta. The heat of transport based on the hydrogen concentration ratio, Q*(C/sub H//C/sub C/), decreased in Ta but increased in Nb as the hydrogen concentration increased. The absolute thermoelectric power of Nb and Ta increased as the hydrogen concentration increased.

18752 (IS-T—1179) Resistivity and strain behavior during transformation cycling in nickel-titanium. Lee, K.H. (Ames Lab., IA (USA)). Sep 1983. Contract W-7405-ENG-82. 73p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84006640.

The effects of stress and transformation fatigue cycling on the resistivity and strain behaviors in Ni-Ti wires were studied. The samples consisted of uncycled wires and wires cycled 5.78 million times in shape memory heat engine devices. Measurements of resistivity and strain were made as a function of temperature at various applied uniaxial tensile stresses. The resistivity-temperature and strain-temperature behaviors were observed to depend on the temperature or the portion of the transformation cycle at which the stress change is made. It was found that the low temperature resistivity and strain increased with increasing stress. Also, the transformation fatigue cycled wires showed a higher and broader resistivity peak with two-stage behavior. The increase in strain with increasing stress is explained in terms of the crystallographic multiplicity of martensite plates and the alteration of the martensite plate structure in response to the applied stress. Prior transformation fatigue cycling causes a decrease in the applied stress dependence of the total strain changes. Also, the shape of curve is changed upon annealing and the M/sub S/ temperature is lowered by transformation fatigue cycling. The lower M/sub S/ temperature upon cycling is due to a stabilization of the high-temperature phase due to transformation-induced dislocations acting as an impediment to further martensite nucleation. Another effect of the stress is to increase the resistivity of the low-temperature phase. However, it was noticed that the stress should be increased above M/sub S/ temperature to increase the resistivity of the low temperature phase. The increase in low-temperature resistivity is partially due to the change in form factor during transformation shape change and due to the alteration of the martensite variants in a preferred direction.

18753 (JAERI-M—9775, pp 130-136) **Neutron irradiation damage in fusion reactor materials.** Shiraishi, Kensuke (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Nov 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-810189—).

From Workshop on the particle material interaction for fusion research; Tokyo, Japan (12 Jan 1981).

The neutron damage in the blanket materials of fusion reactors is so important that it influences the success of fusion reactors as power reactors. The stainless steel equivalent to SUS 316 (JIS), with rich working experiences as a material for fast breeder reactor core, is the only material presently considered as the blanket material for fusion power reactors because of its comparatively well-arranged test data and industrial high reliability. Though the improved stainless steel, whose composition was determined based on the experiences in the process of developing it as a material for fast breeder reactors is estimated to be superior to the material equivalent to SUS 316 as the blanket material in fusion reactors, its irradiation test data are extremely few. Therefore, it is urgently needed for that material to accumulate the data by neutron irradiation test, required to exactly predict the endurance limit. Instead of the neutron irradiation test, it can be hit by the heavy ion irradiation using an accelerator, because irradiation for a very long time is necessary if the neutrons from a fission reactor are used. However, the result thus obtained is different from that obtained with a fission reactor. After all, since there is no single irradiation facility which can simulate the irradiation environment of fusion reactors, the neutron irradiation damage must be estimated by accumulating the irradiation test data utilizing many neutron irradiation facilities and by mutually relating those data. The irradiation environment in fusion reactors is also explained.

18754 (Juel-Spez—200) Irradiation embrittlement of pressure vessel steels. Ghoneim, M.M.; Zahra, A.A.; Hammad, F.H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie). Mar 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750730.

The results of the IAEA "Coordinated Research Programme on Irradiation Embrittlement of Pressure Vessel Steels" were examined again to analyse the reasons behind the reported large scattering and discrepancies in the effect of irradiation on the ductile-brittle transition temperature (DBTT). It is concluded that using specimens from different locations throughout the HSST steel plate thickness was the main reason behind the scattering in these results. Specimens from different locations had different microstructures and different initial mechanical properties which led to different irradiation sensitivities. The analysis showed that the specimens used can be considered to consist of two sets different in microstructure, mechanical properties and irradiation sensitivity. Set 1 composed of specimens taken from positions between T/4 and T/2 throughout the plate thickness while set 2 composed of specimens taken from positions between the surface and T/4. In this way the scattering became very small and even negligable and the discrepancies were explained.

18755 (KFK—3571) Theory and measurement of properties of two-phase materials in the plastic-viscous deformation range. Saeltzer, W.D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Aug 1983. 231p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84750872.

An extensive literature survey shows, that theoretical equations available are inadequate to predict the viscosity of suspensions without limitation of the concentration of the dispersed phase, the shape and orientation of the suspended particles. Based on physically derived and experimentally verified equations for the theoretical prediction of transport and/or field properties of solid two-phase materials with penetration structure, an attempt has been made to predict the viscosity of suspensions and the high temperature creep of two-phase solid materials with the aid of so-called structure parameters. The justification for the treatment of the problem in such a way is given by the consideration of the viscocity as a transport property and by the existing analogies between viscous and viscoplastic deformation.

18756 (KFK—3602) New approach for stress rupture data extrapolation. Bocek, M.; Wolf, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). Sep 1983. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750884.

In the paper a new approach for long time extrapolation of stress rupture data is presented. The main results which first have been applied on SS AISI 304 can be summarized as follows: For long time extrapolation the analytical description of stress rupture lives (SRL) by usual log sigma vs. log tsub(f) diagrams is inappropriate. There are other stress rupture functions F(sigma,tsub(f)) which are more suitable for life time extrapolations. Best results were obtained with a function of the type tsub(f)(sigma) proportional sinh βsigma. This function allows a better understanding about the nature of the life time determining mechanisms. The analysis of the stress rupture data from SS AISI 304 has shown, that two sequentially dependent mechanisms govern the life time.

18757 (LBL—16262) Influence of viscous environments on fatigue crack propagation in a lower strength steel. Tzou, J.L. (Lawrence Berkeley Lab., CA (USA)). Jun 1983. Contract AC03-76SF00098. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008247.

Portions are illegible in microfiche products; Thesis.

The effect of dehumidified silicone and paraffin oils with viscosities from 5 to 60,000 centistokes (cS) on fatigue crack propagation in a lower strength 2 1/4Cr-1Mo pressure vessel steel (ASTM A542 Class 3) was studied at both near-threshold ($\leqq 10^{-6}$ mm/cycle) and higher ($\sim 10^{-6}$ to 10^{-3} mm/cycle) growth rates. It is found that, at low load ratios, crack growth rates in oils are lower than in moist air and dry hydrogen and increase in increasing oil viscosity in higher growth rate region. However, at near-threshold levels, crack growth rates in oils are considerably higher than in moist air and are not affected by the viscosity of oil. At high load ratios, although crack propagation in oils is slower in higher growth rate region and unchanged at near-threshold levels when compared to that in moist air, no effect of oil viscosity can be observed. Such observations are discussed and quantitatively analyzed in terms of three mutually competitive mechanisms specific to dry

viscous environments, namely suppression of moisture-induced hydrogen embrittlement and/or metal dissolution, minimization of oxide-induced crack closure and hydrodynamic wedging effects of the viscous fluid within the crack.

18758 (NUREG/CP—0041-Vol.4, pp 94-118) **Compact specimen geometry and elastic compliance test method effects on the J-integral R-curve.** Gudas, J.P.; Davis, D.A.; Vassilaros, M.G.; Sutton, G.E. (David Taylor Naval Ship R & D Center, Annapolis, MD). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The paper summarizes work aimed at evaluating the sensitivity of the J-integral resistance-curve with respect to the specimen geometry and elastic unloading range.

18759 (NUREG/CP—0041-Vol.4, pp 119-146) **Degraded pipe experimental program.** Gudas, J.P.; Vassilaros, M.G. (David Taylor Naval Ship R & D Center, Annapolis, MD). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Outlined is an evaluation of the J-integral resistance curves from 8 inch diameter A106 Class C steel pipe and compact specimens and of the tearing instability analysis with A106 Class C pipes in bending. Experimental procedures are briefly described.

18760 (NUREG/CP—0041-Vol.4, pp 307-315) **New method for analyzing small scale fracture specimen data in the transition zone.** Merkle, J.G. (Oak Ridge National Lab., TN). Jan 1983. NTIS, PC A14/MF A01 - GPO $9.00. (CONF-821037—Vol.4). Contract W-7405-ENG-26.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A discussion is presented of the problems related to the use of small specimens for measuring fracture toughness with respect to data scatter and size effects.

18761 **(PB—84-132893) Seitetsu kenkyu, number 311, September 1983.** (Nippon Steel Corp., Tokyo). Sep 1983. 129p. NTIS, PC AE07/MF E01.

This special issue on steel for Intermediate-and High-Temperature Service contains research reports on Trends in High Temperature System and Their Material Requirement; Deterioration of Mechanical Properties of Low Alloy Steels during Service at Elevated Temperature; Heavy Stainless Steel Plate for Fast Breeder Reactors; Application of Stainless Steels to High-Temperature Service; Development of High Steel Plates for Intermediate and Room Temperature Pressure Vessel Service; Electric Resistance Welding Rifled Boiler Tube; Development of High Strength Ferritic Stainless Steel Boiler Tube; System for Processing Creep Data, as well as the following general reports: System for Predicting Sintering Operation; Continuous Casting of Pseudo-Rimmed Steel Using In-Mold Electromagnetic Stirrer; Computer Simulation for Continuous Caster Engineering Analysis and Simulation and PERT Models for Man-Machine Operation Study.

18762 **(PB—84-136175) Passive films, surface structure and stress corrosion and crevice corrosion susceptibility. Final report Oct 82-Sep 83.** Kruger, J.; Ritter, J.J.; Long, G.G.; Kuriyama, M.; Goldman, A.I. (National Bureau of Standards, Washington, DC (USA)). Nov 1983. 47p. (NBSIR—83-2790). NTIS, PC A03/MF A01.

This document contains: Structural studies on passive films using surface EXAFS, EX-SITU and IN-SITU sample and detector chambers for the study of passive films using surface EXAFS, and Ellipsometric studies of chelating inhibitor effects on the cathodic delamination of an organic coating on iron.

18763 **(PB—84-138924) Corrosion behaviour of materials at elevated temperatures in an oxidising atmosphere containing sulphur derivatives: influence of the compositon of aggressive phases and of the tested alloys. Final report .** Cappelaere, M.; Lechaudel, R.; Turcot, G. (Commission of the European Communities, Luxembourg). 1984. 60p. (EUR—8249-FR). NTIS, PC E04/MF E04.

Investigations on the resistance of Alloy 800, Uranus S, and Fe-Cr-Al (5.4% Cr, 3% Al) to sulphur dioxide have been carried out, considering three variables:- (1) duration of tests, (2) pressure of sulphur dioxide, and (3) concentration of bromine (10 and 100 x 10 to the minus 6 power by weight).

18764 **(PB—84-140177) Vanadium-uranium extraction from Wyoming vanadiferoud silicates. Report of investigations/1983.** Hayashi, M.; Nichols, I.L.; Huiatt, J.L. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). Nov 1983. 16p. NTIS, PC A02/MF A01.

The Bureau of Mines conducted laboratory studies on low-grade vanadiferous silicates from the Pumpkin Buttes and Nine Mile Lake deposits of Wyoming to examine techniques for extracting vanadium and uranium. Recovery from low-grade sources such as these could contribute to future vanadium production and reduce reliance on vanadium imports.

18765 **(PB—84-140342) Damage cost models for pollution effects on material. Final report.** McCarthy, E.F.; Stankunas, A.R.; Yocom, J.E. (TRC Environmental Consultants, Inc., Wethersfield, CT (USA)). Jan 1984. 149p. NTIS, PC A07/MF A01.

Two economic benefit models were developed to quantify the effects of ambient air pollutants on manmade materials exposed in urban environments. The models use existing physical damage functions, estimates of material in place and average repair or replacement costs to calculate the use life maintenance costs as a function of air pollutant concentration.

18766 **(SAND—84-0415C) Corrosion of proposed canister materials in salt repositories.** Diegle, R.B.; Sorensen, N.R.; Glass, R.S. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840307—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008030.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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Research at Sandia is focusing on TiCode-12 (Ti-0.3Mo-0.8Ni) as a corrosion resistant alloy for fabricating canister overpacks, and possibly the canisters themselves. Tests involving the straining of this alloy at applied anodic overpotentials in brine showed that it does not stress corrode. If hydrogen is introduced, either by cathodic polarization in brine or by electrochemically charging prior to testing, embrittlement can occur. Results from gas-charged specimens indicate that noticeable embrittlement occurs at hydrogen concentrations above about 400 wppm. Pitting was not observed after experiments involving exposure of coupons for several weeks to neutral brine at temperatures up to 200°C. It did occur during two test involving brine previously acidified to pH 2, and then only under adherent salt deposits that develop during the tests. These conditions of low pH and adherent salt layer represent an overtest, and pitting is not anticipated in a salt repository. The effects of Ni and Mo alloy additions on the electrochemistry of corrosion of TiCode-12 were characterized. The uniform corrosion rates of Ni, Fe, and Ti-based alloys that are being considered as alternate, or backup materials to Ticode-12, were measured in brine. No localized corrosion occurred, and the rates of uniform attack of the Ni and other Ti-base alloys were sufficiently low to qualify them as alternate alloys to TiCode-12. The corrosion rate of cast iron in deaerated brine was 0.13 mm/yr, indicating that cast iron is a corrosion allowance material for potential use in canister. 10 references, 7 figures, 1 table.

18767 **Defects and property changes in ion and neutron irradiated metallic glasses.** Grundy, P.J.; Parker, S.F.H.; Jones, G.A. (Salford Univ. (UK). Dept. of Pure and Applied Physics). *Nuclear Instruments and Methods in Physics Research;* **209/210**: 421-426(May 1983). (CONF-820945—).

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

The possible existence of structural defects in non-crystalline atomic arrangements and the resistance of amorphous metals to radiation damage are two important and related subjects in the study of metallic glasses. This paper presents some results of experiments attempting to produce irradiation induced defects in metallic glasses. After irradiation with neutrons and ions, $Fe_{80}B_{20}$ and $Fe_{78}Mo_2B_{20}$ specimens were investigated by differential scanning calorimetry and transmission electron microscopy. Irradiation induced gas bubbles are observed in ion irradiated specimens but no obvious localised defects were found in the neutron irradiated specimens examined. However, changes in crystallization temperature and Curie point were found in the neutron irradiated materials. These findings are briefly discussed in terms of the possible effects of structural and chemical changes in irradiated metallic glasses.

18768 **Irradiation of tungsten with metallic diatomic molecular ions: atomic resolution observations of depleted zones.** Pramanik, D.; Seidman, D.N. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering; Cornell Univ., Ithaca, NY (USA). Materials Science Center). *Nuclear Instruments and Methods in Physics Research;* **209/210**: 453-459(May 1983). (CONF-820945—). Contract AC02-76ER03158.

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

Direct evidence, on an atomic scale, is presented for the enhancement of damage production per projectile ion in diatomic metallic molecular ion (dimer) irradiations of tungsten as compared to monatomic metallic ion (monomer) irradiations. Irradiations were performed in situ at <= 10 K, in a field-ion microscope, employing 20 keV Ag^+ or W^+ monomer ions and the results are compared with 4O keV W_2^+ or Ag_2^+ dimer ion bombardments; the average energy per ion was 20 keV. Firstly, in the near-surface region the depleted zones produced by the W_2^+ dimer ions give rise to void-like contrast effects. The W^+ monomer ions do not produce this void-like damage. The existence of voids was explained employing a classical nucleation and diffusion-limited growth model. Secondly, by counting the number of vacancies in individual depleted zones, produced by the different ions, it was demonstrated that the number of vacancies produced per incoming ion of the dimer is 1.55 times the number of vacancies produced per monomer ion. This constitutes direct evidence for non linear (or spike) effects during the creation of collision cascades by the metallic dimer ions. Further information is presented concerning the dimensions of the depleted zones band the values of the average concentration of vacancies in depleted zones.

18769 **Corrosion studies on Mo- and Cr-bearing alloys for flue gas desulfurization systems.** Maiya, P.S. (Argonne national laboratory). *Proceedings - Electrochemical Society;* **83-5**: 339-340(1983).

Critical components of flue gas desulfurization (FGD) systems, especially those in downstream locations (e.g., stack linings, ducts, bypass-duct junctions, and reheaters), are subjected to environments in which the pH can vary from as low as 0.5 to about 4.0. Hence, proper selection of materials of construction through an appropriate research and development plan can be expected to have great economic impact on current FGD technology. Also to facilitate a mechanistic understanding of the corrosion process in FGD environments, a quantitative description of the effects of pertinent variables such as pH, alloy composition, and chloride ion concentration on corrosion rates is required. In the present study, the corrosion rates of several alloys of interest to FGD systems (viz., 316L, 317LX, 317LM, 904L, A1-4X, A1-6X, Hastelloys G and C-276, Incoloy 825, Inconel 625, and 29-4-2) have been evaluated in sulfuric acid containing 0.03-5.0 wt% Cl^- at different pH levels (0.5-3.0) and at a temperature of 85°C.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 18027, 18895

18770 **(BMFT-FB-T—83-198) Ceramic components for gas turbines. Phase 2.** Tiefenbacher, E.; Girntke, H.; Heinze, R.; Moergenthaler, K.D.; Neubrand, F.; Raeuchle, W.; Stute, M.; Sulzbacher, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1983. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750489.

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In the research program "Ceramic Parts for Gas turbines", Daimler-Benz AG has worked in the following fields: turbine rotor, turbine scroll, recuperative heat exchanger, chemical vapor deposition. A number of monolithic turbine rotors have been manufactured by a process which has been developed by Daimler-Benz AG. These rotors were tested. Two stress calculation methods for turbine rotors were compared. A first Turbine scroll and samples of a recuperative heat exchanger have been tested. The development of chemical vapor deposition was concluded.

18771 **(CONF-811298—Summs.) Ceramics as construction materials.** (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.). Inst. fuer Werkstoff-Forschung). [nd]. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84770162.

From Materials colloquium on ceramics as construction materials; Koeln-Porz, F.R. Germany (3 Dec 1981).

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The volume contains summaries of eight lectures held on the occasion of the material colloquium on 3.12.1981 in the institute for material research of the DFVLR in Koeln-Porz. The subjects treated are: Development of pressureless sintered Si_3N_4 with added Y_2O_3 and Al_2O_3, hot isostatic pressing of Si_3N_4, influence of the microstructure on the thermoshock behaviour of Si_3N_4, thermal fatigue behaviour of Si_3N_4, influence of the oxidation on the short and long-term strength of RBSN under tensile stress at room temperature and varied temperatures, determination of the fracture resistance of ceramic materials with samples of different notch form, indentation fracture mechanics and rupture life prediction of ceramic materials. This is followed by a short description of the poster review with contribution on technology and microstructure characterization of Si_3N_4, tests on high-temperature flexural and tensile strength, determination of the fracture resistance, lifetime prediction and thermal fatigue. The volume concludes with a list of the publications of the institute for the years 1979 to 1981.

18772 (INIS-SU—197, pp 81-83) **Radiation-optical processes in leucosapphire and ruby crystals with magnesium additions.** Bessonova, T.S.; Stanislavskij, M.P.; Akulenok, E.M. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki; AN SSSR, Moscow. Inst. Kristallografii). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

Effect of magnesium addition on electron-hole processes in leucosapphire and ruby crystals is investigated. The role of intrinsic and impurity defects under irradiation is studied. Data on spectra of initial and induced absorption, kinetics and spectral composition of radioluminescence, parameters of thermoluminescence curves are obtained. Anion vacancies (V_0) and chromium addition represent centers of absorption and radioluminescence in crystals heat treated in vacuum. Crsub(Al) color centres are formed in Mg-ruby after heat treatment in oxygen while in Mg-sapphire neutral centres Mgsub(Al)sup(x) and multiparticle complexes are also formed. Under crystal radiation the same color centres as under oxidation heat treatment arise. Presence of multiparticle complexes being an effective outlet for secondary electron-hole pairs in Mg-corundum prevents charge accumulation on other traps. Based on the results obtained it can be concluded that all the bands of induced optical absorption in ruby belong to centres of one type and they are connected with hole capture on Cr-traps. Magnesium doping increases crystal defectiveness, brings about formation of new local levels in

Al_2O_3 lattice and changes procedure of all the radiation-optical processes.

18773 (INIS-SU—198, pp vp) **Study on radiation effect on NaFesub(1-x)Alsub(x)Osub(2).** Zhetbaev, A.K.; Vereshchak, M.F.; Dzholdybaev, M.S.; Donbaev, K.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18774 (INIS-SU—198, pp vp) **Angular correlation of annihilation quanta in lead germanate.** Zakharyants, A.G.; Maloyan, A.G. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18775 (KFK—3374-B) **Constitution, preparation, and properties of refractory compounds and systems (hard materials and hard metals).** Holleck, H.; Thuemmler, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). Feb 1983. 160p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

A progress report of the work done in the years 1980-1982 is given. The subjects of this report are the constitution and the mechanical properties of hard metals, mainly cemented tungsten carbides.

18776 (KFK—3583) **Equation of state for non-stoichiometric urania using significant liquid structures theory.** Fischer, E.A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Oct 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750885.

The Significant Liquid Structures Theory (SST) by Eyring, which was used earlier to analyse the Equation of State of UO_2, is extended in this paper to non-stoichiometric urania. This is done by introducing an oxygen defect model in the "solidlike" partition function of the SST, and by including several gaseous species in the "gaslike" partition function. A grand partition function is used to describe the urania system, with the oxygen chemical potential as a variable. The equations are developed for hyperstoichiometric material; however, they may also be used for hypostoichiometric urania or plutonia. An extension to mixed oxide seems feasible, with some additional assumptions. Numerical results for two different data sets are presented.

18777 (RFP—3456) **Evaluation of the surface properties of calcined plutonium peroxide.** Stakebake, J.L.; Robinson, H.N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 24 Feb 1984. Contract AC04-76DP03533. 19p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008208.

Seven batches of calcined plutonium peroxide were prepared and characterized by nitrogen and argon adsorption. The surface areas of all batches were similar and unaffected by grinding, indicating most of the exposed area was internal. Water vapor adsorbed on the plutonium dioxide was found to decrease nitrogen adsorption at -196°C and thereby reduce the BET surface area. Porosity analysis by both the t and α/sub s/ methods showed the oxide contained mesopores and possibly macropores, but no micropores. Pore structures of the samples were evaluated by the modelless method where the average hydraulic core diameter was 22 A.

18778 (SAND—83-1954C) **Micro-Raman spectroscopy of fresh and aged silica gels.** Klein, L.C.; Nelson, C.; Higgins, K.L. (Rutgers--the State Univ., Piscataway, NJ (USA). Dept. of Ceramics; Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 18p. (CONF-840258—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008334.

From Materials Research Society spring meeting; Albuquerque, NM, USA (27 Feb 1984).

Raman spectra were obtained from fresh and aged silica gels using micro-Raman techniques. Comparison of the spectra from wet and dried gels reveals the stages of reaction in the ethanol-TEOS-water system and the gradual development of the silica structure. The steady disappearance of bands assigned to ethanol and the appearance of bands assigned to hydroxyl can be traced during the drying process. Increases in either acid concentration or water level increase reaction rates to give gels in a more advanced stage of polymerization. Gels tend to develop fluorescence upon aging for several months. The source of this fluorescence could not be determined, but its development can be prevented by heating freshly dried gels to about 155°C.

3603 Composite Materials

REFER ALSO TO CITATION(S) 18891

18779 (DOE/ER/45045—1) **Effect of fatigue and thermal loads on silicon carbon fiber reinforced glas matrix composites. Progress report, 15 August, 1983-31 January, 1984.** Avva, V.S.; Sankar, J. (North Carolina Agricultural and Technical State Univ., Greensboro (USA)). 8 Feb 1984. Contract AS05-83ER45045. 4p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007464.

This brief summary covers specimen acquisition, specimen gripping device, high-temperature furnace, and scheduled research effort. No data are given. (DLC)

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 18595, 19593

18780 (DOE/ER/10655—5) **Polymers in mechanochemical systems: structure-property requirements. Progress report, June 1, 1983-May 31, 1984.** Mandelkern, L. (Florida State Univ., Tallahassee (USA)). 1984. Contract AS05-80ER10655. 15p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007290.

Research carried out during this period has been concerned with mechanical properties and ultimate strength of the polyethylenes, the analysis of low frequency dynamic mechanical behavior, and studies of the carbon-thirteen crystalline spin-lattice relaxation times in these polymers. The basic principle underlying all these studies is control of the major independent structural variables which govern the properties in the semi-crystalline state. The ultimate properties, strain and tensile strength at break, have been found to be dependent on molecular weight and to be independent of the level of crystallinity and supermolecular structure. The yield stress depends primarily on the level of crystallinity, while the initial modulus depends in a complex manner on molecular weight, crystallinity and crystallite thickness. The low-frequency, low-temperature relaxation is shown to be a characteristic of the noncrystalline region and a significant difference in magnitude is found between the linear and branched polymers. The crystalline spin-lattice relaxation times are found to depend primarily on the crystallite thickness, but are tempered to some extent by the nature of the interfacial structure.

18781 (DOE/ER/10655—T1) **Dynamic mechanical studies of the α and β relaxations of the polyethylenes.** Popli, R.; Glotin, M.; Mandelkern, L.; Benson, R.S. (Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics; Utah Univ., Salt Lake City (USA). Dept. of Materials Science and Engineering). 1983. Contract AS05-80ER10655. 103p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84007568.

The α and β relaxations of polyethylenes have been studied using low frequency dynamic mechanical methods. The main focus of this work has been both the control and quantitative measurement of the key structural factors that describe semi-crystalline polymer systems. The structural factors that have been examined in detail include the level of crystallinity, the crystallite thickness, the

interfacial content and the supermolecular structure. Consequently a variety of other type supplementary measurements were made to accomplish the necessary characterization. The location of the α-transition is found to depend primarily on the crystallite thickness. There also is the distinct possibility that the interfacial structure exerts an important influence. The level of crystallinity and the supermolecular structure do not play any significant role in the location of T/sub α/. A strong correlation is found with the carbon-13 NMR crystalline T_1, which is reported in a separate paper. By analyzing the influence of the different structural factors on the β-transition, it is concluded that this transition results from the relaxation of chain units which are located in the interfacial region. The elusiveness of this transition and the contradictory reports that have existed in the literature are given a ready explanation. The enhancement of this transition by branching and copolymerization follows naturally as does its invariance with co-unit content.

18782 (INIS-SU—198, pp vp) **Positron annihilation study on structural transxtions in polybutadiene.** Arifov, P.U.; Vasserman, S.K.; Emelin, N.N.; Tishin, S.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18783 **(KAERI/RR—354/82) Study on the radiation effect of plastic syringe materials.** Byun, H.C.; Yun, B.M.; Kim, K.Y.; Kong, Y.K.; Park, H.Y. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 52p. (In Korean). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700089.

From the viewpoint of gammasterilization, the defects of domestic polypropylene as syringe material are worse mechanical properties and discoloration by irradiation. Therefore, domestic polystyrene (GPPS 150) was inspected to use as a substitute for the polypropylene. The gel point of the polystyrene was about 100Mrad and no momentous change of the mechanical properties appeared until the dose reached to that point. Above the point, as the crosslinking reaction proceeded both strength of tensile and impact increased with discoloration. No significant problem was found in the water extract test and chemical resistance test. In addition to the pure polystyrene, the copolymer of butadiene (HIPS 425) and the blend material of polypropylene were also inspected for the purpose and almost the same results were obtained in the irradiation. From the above result, it is considered that polystyrene and the copolymer and the blend mentioned above are available for medical plastics which would be sterilized by gamma-radiation.

18784 **(SAND—83-1063C) Role of order in pyroelectricity of PVF_2.** Kepler, R.G.; Anderson, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 16p. (CONF-8308161—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007572.

From Symposium on order on polymeric materials: implications for electronic, magnetic, and optical phenomena; Waltham, MA, USA (25 Aug 1983).

A series of studies of the pyroelectric effect in polyvinylidene fluoride indicates that reversible changes in the amount of order in the polymer films plays an important role in the pyroelectric effect. Experiments were conducted which showed that only one-half to two-thirds of the total pyroelectric effect can be accounted for on the basis of the usual primary and secondary effects. This observation led to the hypothesis that reversible changes with temperature of the crystallinity of the semicrystalline polymer might account for the rest. This hypothesis predicted that the crystallinity of the polymer should depend on the magnitude of an applied electric field. Experiments have been conducted in which this effect was observed.

18785 **(SFB—80/ET/208) Influence of high-polymer substances on percolating flows.** Haas, R. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich Ausbreitungs- und Transportvorgaenge in Stroemungen). Jun 1982. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750504.

The chapter of effect of high-polymer-substances on expansion flows discusses flow through spherical packing in consideration of expansion flow amount. The chapter of theory of expansion flows with diluted high polymer solutions contains kinetic theory of diluted solutions of flexible macromolecules and modification of expansion viscosity equations for pore flows. The chapter of experimental investigations presents characterization of used polymer types and their solvents and characterization of polymer effects in the different pore geometries. The chapter of experimental results of polymer effect in occasional packings and comparsion to theory deals with variation of hydromechanical and chemical-physical parameters, comparison of maximum obtainable expansion viscosity increase from theory and experiment and characterization of temporal and mechanic degradation of polymer solutions.

18786 **Positron annihilation in γ-irradiated polyamide-6.** Bardyshev, I.I.; Goryaev, V.M.; Spitsyn, V.I. (AN SSSR, Moscow. Inst. Fizicheskoj Khimii). pp vp of Proceedings of the 5th 'Tihany' symposium on radiation chemistry held at Siofok, 19 - 24 Sep 1982. Budapest, Hungary; Mueszaki es Termeszettudomanyi Egyesueletek Szoevetsege (1982). (CONF-8209164—Summ.).

From 5. Tihany symposium on radiation chemistry; Siofok, Hungary (19 Sep 1982).

3606 Other Materials

REFER ALSO TO CITATION(S) 18161, 18175, 18185, 18247, 18345, 18345, 18348, 18349, 18351, 18358, 18359, 18767, 18893, 19261, 19465

18787 **(AD-A—135340/8) Studies of silicon refractory metal interfaces: photoemission study of interface formation and compound nucleation. Final report 15 Jul 81-14 Apr 83.** Weaver, J.H. (Wisconsin Univ., Madison (USA)). 8 Sep 1983. 44p. NTIS, PC A03/MF A01.

Examined are the electronic and morphological interactions which occur at the interface between silicon and a variety of metals, including Cr, Ti, Sm, Au, and Ca. These interface studies were supported by extensive synchrotron radiation photoemission studies of bulk silicides, including Ti2Si5, TiSi2, VSi2, NbSi2, CrSi2, MoSi2, TaSi2, FeSi2, CoSi2, Ni2Si, NiSi, NiSi2, and Pd2Si and by calculations of the density of states of silicides. Identified are the important parameters in the formation of the metal-silicon bond. Demonstrated is the systematic development of the Si-metal p-d hybridization and the reduction of the Si sp3 bond.

18788 **(CONF-830887—3) High temperature Guinier x-ray diffractometry for thermal expansion measurements in the hexagonal form of cordierite ($2MgO.2Al_2O_3.5SiO_2$).** Pressnall, J.S.; Fitzpatrick, J.J.; Predecki, P. (Denver Univ., CO (USA)). 1983. Contract AC02-81ER10896. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007890.

From Joint meeting of American Crystallographic Association and Denver X-ray conference; Snowmass, CO, USA (1 Aug 1983).

Portions are illegible in microfiche products.

A computer-controlled high temperature Guinier diffractometer system for accurate determination of lattice thermal expansion is described. A critical test of the system using α-Al_2O_3 (0.3μ polishing alumina) showed close agreement with the single crystal expansion data of Wachtman et al. Lattice thermal expansion of cordierite doped with the following dopants: Ge^{+4}, P^{+5}, Zn^{+2}, Li^{+1} and Ca^{+2} was investigated. Of these the Li^{+1} at the 5% level (5% of Si^{+4} replaced by Li^{+1} + Al^{+3}) produced the largest decrease in mean lattice expansion.

18789 **(CONF-831174—82) Displacive phase transformation in vanadium-substituted lanthanum niobate.** Aldred, A.T.; Chan, S.K.; Grimsditch, M.H.; Nevitt, M.V. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 7p. NTIS, PC A02; 3; GPO Dep. Order Number DE84006717.

From Materials Research Society annual meeting; Boston, MA, USA (14 Nov 1983).

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The displacive transformations in complex oxides of the type LaNb/sub 1-x/V/sub x/O_4 has been studied by x-ray diffraction and Raman scattering for $0 \leqq x < 0.3$. X-ray diffraction results indicate that the transformation from the tetragonal high temperature structure (C/sub 4h/^{6}) to the monoclinic low-temperature structure (C/sub 2h/^{6}) is higher than first order and that the transformation temperature T/sub c/ is depressed significantly by V substitution. Raman scattering results show that the force constant between the nearest (Nb,V)O_4 tetrahedral units behave uniquely compared to others. It softens at T/sub c/ as a function of composition and it also softens as a function of temperature as T/sub c/ is approached from above.

18790 **(DP-MS—83-115) Selection of fluids for tritium pumping systems.** Chastagner, P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Feb 1984. Contract AC09-76SR00001. 25p. (CONF-840267—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008288.

From 13. annual symposium on applied vacuum science and technology; Clearwater Beach, FL, USA (6 Feb 1984).

The degradation characteristics of three types of vacuum pump fluids, polyphenyl ethers, perfluoropolyethers and hydrocarbon oils were reviewed. Fluid selection proved to be a critical factor in the long-term performance of tritium pumping systems and subsequent tritium recovery operations. Thermal degradation and tritium radiolysis of pump fluids produce contaminants which can damage equipment and interfere with tritium recovery operations. General characteristics of these fluids are as follows: polyphenyl ether has outstanding radiation resistance, is very stable under normal diffusion pump conditions, but breaks down in the presence of oxygen at anticipated operating temperatures. Perfluoropolyether fluids are very stable and do not react chemically with most gases. Thermal and mechanical degradation products are inert, but the radiolysis products are very corrosive. Most of the degradation products of hydrogen oils are volatile and the principal radiolysis product is methane. Our studies show that polyphenyl ethers and hydrocarbon oils are the preferred fluids for use in tritium pumping systems. No corrosive materials are formed and most of the degradation products can be removed with suitable filter systems.

18791 **(INIS-mf—8311) Studies on the tracer diffusion of copper in silver bromide, copper(I) bromide, and lithium bromide in comparison with conductivity and nuclear resonance measurements.** Schaefgen, H.P. (Bochum Univ. (Germany, F.R.). Abt. Chemie). 8 Jul 1982. 191p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780105.

In the present thesis measurements on the diffusion of copper in silver bromide, copper (I) bromide, and lithium bromide are reported. The results obtained by tracer diffusion measurements are compared with results from conductivity and nuclear resonance measurements.

18792 (INIS-SU—197, pp 86-88) **Transient processes and production of defects in n-Si and n-Ge under powerful electron pulsed irradiation.** Vojtsekhovskij, A.I.; Krajchinskij, A.N.; Mizrukhin, L.V.; Shakhovtsov, V.I. (AN Ukrainskoj SSR, Kiev. Inst. Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

Defect formation in n-Si and n-Ge under powerful electron pulsed irradiation is investigated. Irradiation has been conducted by electron single pulses (tausub(u)=3.7 μs; Esub(e)=3 MeV) in the 10^{15}-10^{18} el/cm^2 intensity range at liquid nitrogen and room temperatures. Concentration of equilibrium charge carriers has been estimated from Hall measurements; constant of linear recombination - by transition processes of non-equilibrium conductivity drop. A sharp increase in the rate of defect introduction into n-Ge with growth of electron radiation intensity is obtained for the first time. The constant of linear recombination and Auger-recombination factor in n-Si and n-Ge are determined according to the new technique. The nature of processes of radiation defect formation in semiconducting crystals is determined by excitation level of non-equilibrium charge carriers. Use of pulsed radiation permits to divide in time the processes of primary and secondary defect formation.

18793 (INIS-SU—197, pp 79-80) **Monsteady, state EPR of radiation defects in silicon.** Erchak, D.P.; Rutkovskij, I.Z.; Stel'makh, V.F.; Fedoruk, G.G. (Belorusskij Gosudarstvennyj Univ., Minsk). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

Investigations of new peculiar features in structural characteristics of the known paramagnetic radiation defects arising in silicon monocrystals after fast reactor neutron and ion irradiation are conducted using detection of transition oscillations of EPR signals. In particular, it is stated that paramagnetic properties of dominating under neutron radiation centres Si-RE-(110)-tetravacancy in neutral charged state and Si-Pb-positively charged splitted $< 100 >$ diinterstitials are not described by means of the known models. The obtained results are explained within the frames of the model accounting for periodical redistribution of energy in the system of exciting photon-magnetic moments and resonance phonons.

18794 (INIS-SU—197, pp 63-65) **Generation and destruction of intrinsic and impurity defects in CsI-Na.** Aluker, Eh.D.; Dejch, R.G.; Chernov, S.A. (AN Latvijskoj SSR, Riga. Inst. Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

Relaxation of absorption bands of Vsub(K)- and Na^0-centres created in CsI-Na crystal by electron pulse (10 ns, 250 keV, 1000 A) is investigated. Data on absorption experiments has been compared with luminescence kinetics (lambda=420 nm) for clarifying mechanism of recombination process resulting in appearance of scintillation. Measurements have been conducted in the 100-250 K temperature range. Absorption drops in band maxima of Vsub(K) and Na^0-centres as well as luminescence damping after the end of accelerator pulse comply with kinetics of the second order. Activation energy for the processes of absorption drop and luminescence damping is equal to 0.19+-0.02 eV that coincides with the value of activation energy or reorientation motion of Vsub(K)-centres in CsI. Activation energy for luminescence growth is equal to 0.13 eV. Based on the obtained experimental data it is concluded that index of recombination process resulting in CsI-Na scintillations is of hole type.

18795 (INIS-SU—197, pp 30-36) **Crystal swelling in the presence of stationary source of gaseous atoms.** Kekchidis, S.N. (Nauchno-Issledovatel'skij Inst. Stabil'nykh Izotopov, Tbilisi (USSR)); Saralidze, Z.K. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

Gas swelling of crystals with a constant source of gas atoms in the crystal volume with account for preferrable absorption by voids of point defects of a certain type caused by pressure affecting the void surface is investigated. An expression for swelling rate is obtained and some interesting extreme cases are analyzed. The problem is solved in quasistationary approximation in which average concentrations of point defects, distribution of voids and dislocations, average curvature of dislocation segments and loops, void surface supposed to be spherical and some other parameters are considered as slowly changing functions of time.

18796 (INIS-SU—197, pp 28-29) **Quantum-chemical simulation of production and tunneling recombination of pairs of Frenkel defects in alkali halides.** Kotomin, E.A.; Shlyuger, A.L.; Tale, I.A.; Kurman, I.S. (Latvijskij Gosudarstvennyj Univ., Riga (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

Quantum-chemical simulation of the mechanism of non-irradiating annihilation of self-localized exciton resulting in production of Frenkel defects in alkali-halide crystals is performed. LiF crystal is considered, in particular. It is shown that at drawing the anion escaping along the $< 110 >$ axis together with the following anion up to smaller distance characteristic for H-centre the electron tunneling back in anion vacancy with production of F-, H-centre pair becomes energetically advisable. Calculations of effectiveness of non-irradiating annihilation reveal that release of almost the total energy of self-localized exciton on an anion is possible, and time of

transition does not exceed 10^{-11} s. The non-irradiating channel dominates for tunnel recombination of F-, H-pairs of defects while the irradiating one - for F-Vsub(k)-pairs.

18797 (INIS-SU—197, pp 3-22) **Radiation defects in crystals.** Indenbom, V.L. (AN SSSR, Moscow. Inst. Kristallografii); Kirsanov, V.V. (AN Kazakhskoj SSR, Alma-Ata. Inst. Yadernoj Fiziki); Orlov, A.N. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

The results of theoretical and experimental investigations into radiation defects in crystals are given and analyzed. Structures and properties of point defects, their effect on crystal properties as well as manifestation of the so-called subthreshold processes proceeding under radiation without formation of stable Frenkel voids are described. Problems of point defect kinetics, their interaction with dislocations and the effect of these processes on physical and mechanical properties of materials as well as on swelling under radiation are discussed. New tendencies in development of radiation material science are retraced. New techniques of investigation are discussed. Prospects for development of the theory of radiation defects and its applications to the analysis of radiation phenomena are outlined.

18798 (INIS-SU—198, pp vp) **Radiation damage profile and positron annihilation in proton-irradiated GaAs.** Pogrebnyak, A.D.; Aref'ev, K.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18799 (INIS-SU—198, pp vp) **Positronium effective mass in alkali halides.** Boev, O.V.; Aref'ev, K.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18800 (INIS-SU—198, pp vp) **Anisotropy of gamma quanta angular distribution in positron annihilation with core electrons in germanium and silicon.** Arifov, P.U.; Arutyunov, N.YU.; Trashchakov, V.Yu. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18801 (INIS-SU—198, pp vp) **Radiation damage of GaP monocristals with ^{31}P and ^{40}Ar ions.** Bugrov, V.N.; Karamyan, S.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18802 (INIS-SU—198, pp vp) **Positron annihilation in deformrd monocrystals of potassium bromides.** Chormonov, A.B.; Somkov, S.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18803 (INIS-SU—198, pp vp) **Positron annihilation study on defects in GaP.** Kudin, A.N.; Makarenko, V.G.; Megela, I.G.; Podzirej, Yu.S.; Tartachnik, V.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18804 **(IS-T—1090) Amorphous silicon-carbon thin films.** Ward, J.F. (Ames Lab., IA (USA)). Sep 1983. Contract W-7405-ENG-82. 75p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007369.

Thesis.

This study has shown that it is possible to produce nearly stoichiometric films of a-SiC:H with high hydrogen content by rf sputtering in an atmosphere of argon, propane, and hydrogen. The a-SiC films adhere to a variety of substrates and exhibit better thermal stability than a-Si:H films. The index of refraction is 2.8. The optical gap energy of these films is between 2.0 and 2.2 eV. A series of isochronal annealing steps show that optical gap energies decrease, optical absorption edge widths increase, and that the minimum optical density in the low absorption region increases with annealing above 450°C. Infrared measurements show large absorptions at 2100, 1000, 750, and 650 cm^{-1} corresponding to SiH stretch, CH wagging, SiC stretch, and SiH wagging vibrational modes. The CH/sub n/ stretch mode near 2900 cm^{-1} is very small. Isochronal annealing causes a nearly continuous decrease in the integrated intensity of the SiH stretch mode at 2100 cm^{-1}. The 2100 absorption peak shape may indicate the presence of SiH_2 in the film. Comparison of the 2100 and 750 absorption peaks show that the Si-C bonds are more heat resistant than the Si-H bonds. Annealing experiments reveal that the decrease in optical gap energy with increasing annealing temperature is probably not due to change in the Si-H bonds. Rather, the decrease is most likely due to changes or breaks in the C-H bonds and possibly the Si-C bonds. NMR results show that the films have high hydrogen concentrations. Also, NMR results and the integrated intensity for the SiH stretch mode give correct order of magnitude determination of the number and concentration of Si-H bonds in the a-SiC:H films.

18805 **(JAERI-M—82-057) Studies on the flame and radiation resistant modification of wires and cables for nuclear power generation plants.** Hagiwara, Miyuki; Morita, Yosuke; Udagawa, Akira; Oda, Eisuke; Fujimura, Shunichi. (Japan Atomic Energy Research Inst., Tokyo). Aug 1982. 77p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84700091.

For the use in the light-water nuclear power generation plants, wires and cables are required to keep high flame retardancy and superior resistivity against heat and radiation throughout the whole period of service. They are expected, further, to fulfill their functions even under LOCA conditions. The present work is aimed to provide new technology to give flame and radiation resistancy to insulating materials for the cables which are used under the above requirements. For the improvement of flame retardancy and the elongation of life time, polymerizable flame retardants were examined for their applicability to ethylene-propylene-diene rubber. Various polymerizable flame retardants were first synthesized, and their performance was analyzed, especially, as to the relationship between molecular structure and their effectiveness. As a guiding principle for developing a high performance flame and radiation resistant reagent, it was suggested that the back born of the reagent molecule should be constructed by carbon-carbon bond including fused aromatic rings and groups which can undergo polymerization by radical initiators. After careful consideration and detailed experimental work, condensed bromoacenaphthylene (con-BACN) was shown to have enough effectiveness for the present purpose. Its satisfactory performance was also shown by making cables of a practical size using con-BACN, and by carrying out various performance tests based substantially on IEEE standards.

18806 (KFTI—81-7, pp 88) **Radiation effect of 8-1000 MeV bremsstrahlung gamma-quanta on silicon.** Maslov, N.I.; Pugachev, G.D.; Khejfets, M.I. 1981. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Radiation damage physics and radiation technology.

Efficiency of radiation effect on silicon of bremsstrahlung gamma quanta of maximum energy Esub(γ)sup(0) in the range of 8-1000 MeV has been experimentally investigated. Factor of radiation damage ksub(tau) showing change in time for lifetime of nonequilibrium charge carriers in a semiconductor depending on the irradiation dose was taken as the parameter determining the efficiency of the effect. It is shown that rapid growth of defect generation efficiency K occurs in the energy range from 20 to 400 MeV. The growth of K is decelerated with the further increase in Esub(γ)sup(0) energy.

18807 **(PB—84-139732) Compatibility of grouts with hazardous wastes. Final report.** Spooner, P.A.; Hunt, G.E.; Hodge, V.E.; Wagner, P.M. (JRB Associates, Inc., McLean, VA (USA)). Jan 1984. 153p. NTIS, PC A08/MF A01.

A study was conducted to determine the known information on the compatibility of grouts with different classes of chemicals. The information gathered here can be used as a basis for testing and selecting grouts to be used at specific waste disposal sites with various leachates. Twelve different types of grouts are included in this study; their inclusion is based on their availability and use in waterproofing and soil consolidation projects. The known effects of each chemical class on the setting time and durability of each grout are identified and presented in a matrix. These data were based on a review of the available literature and contact with knowledgeable persons in industries, universities, and government agencies. The physical and chemical properties, reaction theory, and known chemical compatibility of each grout type are discussed.

18808 **(SAND—83-1958C) ^{1}H NMR studies of the sol-gel transition.** Assink, R.A.; Kay, B.D. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-840258—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008028.

From Materials Research Society spring meeting; Albuquerque, NM, USA (27 Feb 1984).

High resolution ^{1}H NMR spectroscopy has been employed to study the dynamics of the sol-gel transition in simple silicates. High magnetic fields (360 MHz) were used to detect and identify the various chemical species present in the $Si(OCH_2CH_3)_4$:C_2H_5OH:H_2O and $Si(OCH_3)_4$:CH_3OH:H_2O sol-gel systems. Using these techniques, the time evolution of the reactant and product species were monitored. Results of these studies have shown that acid and base catalyzed systems react along very different chemical pathways and that the elementary hydrolysis and condensation reactions occur on widely different time scales. The use of these experimental data to test possible mechanisms is discussed.

18809 **Hydrogen bond formation and anion ordering in superconducting $(TMTSF)_2ClO_4$ and $(TMTSF)_2AsF_6$.** Beno, M.A.; Blackman, G.S.; Leung, P.C.W.; Williams, J.M. (Argonne National Lab., IL (USA)). *Solid State Communications;* **48**: No. 2, 99-103(Oct 1983).

An examination of the low temperature (125K) X-ray diffraction determined structure of $(TMTSF)_2ClO_4$, the only ambient pressure organic superconductor known, reveals a previously unseen nearest-neighbor hydrogen bonding environment surrounding the anion resulting in short oxygen atom to methyl-hydrogen atom interactions that are likely responsible for the ordering of the ClO_4^- anion associated with a transition observed at 24K. Superconductivity is observed in $(TMTSF)_2ClO_4$ only when the anions adopt an ordered (relaxed[1]) configuration. In contrast to the previously reported single short Se...O distance, the O...H-C contacts are both short and numerous. The observed vibrational motion of the perchlorate anion provides further support for the importance of the O...H interactions in the pinning of the anion. Additional discussion regarding the influence of F...H hydrogen bonds on the AsF_6^- anion disorder in $(TMTSF)_2AsF_6$, a superconductor under applied pressure only, is also presented.

18810 **Review of mercuric iodide development program in Santa Barbara.** Lamonds, H.A. (EG and G, Inc., Santa Barbara, CA (USA). Operations Goleta). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 5-12(15 Jul 1983). (CONF-820667—). Contract AC08-83NV10282.

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

Also published as report DOE/NV--10282-T1, 1982.

Crystal growth and device fabrication methods used at EG and G Santa Barbara are reviewed. The chemical and structural characterization of the grown crystals briefly described. The experimental results presented, especially with respect to the spectral response of detectors with thicknesses of 1 cm or more, indicate the large potential of mercuric iodide as a material for future detector applications.

18811 **(UCRL-Trans—11956) Growth and frequency doubling characters of heavily doped Mg:$LiNbO_3$ crystals.** Zhong, J.G.; Xu, G.F.; Wang, T.F.; Zhang, C.Y.; Lu, Y.C.; Lu, C.G.; Cher, J.R. Translated from *Wu Li Hsueh Pao ;* **32**: No. 6, vp(Jun 1983). Contract W-7405-ENG-48. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009441. DE84009441

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By determining the relations between the effective distribution coefficient of MgO in the congruent $LiNbO_3$ and the phase-matching temperature and the concentration of MgO, chemical composition which makes the Mg:$LiNbO_3$ to get the highest phase-matching temperature has been found. The problems frequently encountered in heavily doped Mg:$LiNbO_3$ crystal growth, such as growth striations and precipitation etc., have been resolved. The Mg:$LiNbO_3$ crystals with high resistance to light-induced refractive index changes and good optical quality have been grown. Using the crystals for frequency doubling of a continuously pumped acousto-optical Q-switch Nd:YAG laser, second harmonic output wih the highest average power of 2 W have been obtained.

18812 **Multiple pass application of the Boltzmann transport equation for calculating ion implantation profiles at low energies.** Giles, M.D.; Gibbons, J.F. (Stanford Univ., CA (USA). Stanford Electronics Labs.). *Nuclear Instruments and Methods in Physics Research;* **209/210**: 33-36(May 1983). (CONF-820945—).

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

The Boltzmann transport equation is used to predict ion implantation profiles at low implantation energies, with particular attention to the effects of ions which are backscattered. In previous work the transport equation was applied stepwise into the target and all backscattered ions were considered stopped at the point where they were scattered. This gives good results when the scattering is forward-peaked. However, when the incident ion is much lighter than the target atoms, a large fraction of the incident ions are backscattered. For example, when boron is implanted into silicon at 15 keV, 60% of the ions are backscattered. To obtain greater accuracy under these conditions, the momentum distribution of the backscattered ions is stored after each step and their motion is followed by making a second pass backward through the implanted layer. Further passes back and forth can be used until all the ions have stopped. The extra ion motion considered will increase the calculated recoil generation. The effects are large at interfaces between light and heavy target layers, such as silicon nitride on gallium arsenide, and may lead to important mixing effects in certain sputtering situations.

18813 **Coherent precipitate formation in Tl implanted Si.** Appleton, B.R.; Narayan, J.; White, C.W. (Oak Ridge National Lab., TN (USA). Solid State Div.); Williams, J.S.; Short, K.T. (Royal Melbourne Inst. of Tech. (Australia)). *Nuclear Instruments and Methods in Physics Research;* **209/210**: 239-242(May 1983). (CONF-820945—).

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

Ion scattering, ion channeling, and cross-section electron microscopy were used to investigate Si single crystals implanted with $^{205}Tl^+$ and annealed with pulses from a ruby laser. Coherent precipitates of Tl were found to form as a result of laser processing. The systematics of the effect are presented and a formation mechanism proposed.

18814 **Structural alterations in SiC as a result of Cr^+ and N^+ implantation.** Williams, J.M.; McHargue, C.J.; Appleton, B.R. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **209/210**: 317-323(May 1983). (CONF-820945—). Contract W-7405-ENG-26.

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

Ion scattering and channeling techniques were used to study production of disorder and randomization of SiC produced by implantation of Cr^+ and N^+. Experiments were designed so that the calculated damage energy profiles would be well matched for the

two ion species. The results were compared for the degree of effectiveness of Cr^+ and N^+ in producing disorder. At higher doses, Cr^+ was much more effective than N^+ for a given damage energy using the same calculational method for Cr^+ as for N^+. In correlated studies of swelling, both species had about the same effectiveness in producing swelling.

18815 **Crystalline to amorphous transformation in silicon.** Washburn, J.; Murty, C.S.; Sadana, D.; Gronsky, R.; Kilaas, R. (California Univ., Berkeley (USA). Div. of Materials and Molecular Research; California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering); Byrne, P.; Cheung, N. (California Univ., Berkeley (USA). Dept. of Electrical Engineering and Computer Sciences). *Nuclear Instruments and Methods in Physics Research;* **209/210**: 345-350(May 1983). (CONF-820945—). Contract AC03-76SF00098.

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

The mechanism of the crystal to amorphous transformation during ion damage in silicon has been investigated using high resolution lattice imaging electron microscopy. Sharp interfaces were observed between amorphous and crystalline regions in partially amorphous silicon. Simulated lattice fringe images for increasing Frenkel pair concentrations were generated which suggest that a sharp change in lattice fringe visibility implies a sharp change in structure. The critical displacement damage necessary to produce an amorphous layer for 11 MeV As implants was shown to increase with temperature and to agree well with the calculated displacement energy absorption versus depth. Amorphous regions were observed to shrink during room temperature 1.2 MeV electron irradiation which suggests that radiation induced shrinkage can contribute to the temperature dependence of the critical dose for amorphization.

18816 **Mechanical response of single crystal Si to very high fluence H^+ implantation.** Choyke, W.J. (Pittsburgh Univ., PA (USA); Westinghouse Research and Development Center, Pittsburgh, PA (USA)); Irwin, R.B.; McGruer, J.N.; Townsend, J.R. (Pittsburgh Univ., PA (USA)); Doyle, N.J.; Hall, B.O.; Spitznagel, J.A.; Wood, S. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). *Nuclear Instruments and Methods in Physics Research;* **209/210**: 407-412(May 1983). (CONF-820945—). Contract AS05-76ER02968.

From International conference on ion beam modification of materials; Grenoble, France (6 Sep 1982).

Single crystals of Si are doped at room temperature with hydrogen from 2 x 10^{16} H/cm^2 to 1.6 x 10^{18} H/cm^2 in a range of energy from 20 keV to 1 MeV. Experiments using RBS/channeling, profilometry and cross-section TEM are reported.

18817 **(ORNL-tr—5078) Yttrium garnet ($Y_3X_5O_{12}$).** Kimura, S.; Honma, S.; Shindo, I.; Miyazawa, Y.; Mori, Y.; Kitamura, K.; Ii, N.; Komatsu, K.; Senkawa, J.; Takei, H. Translated from *Muki Zaishitsu Kenkyusho Nempo ;* 64-68(1977). Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006623. DE84006623

The authors have conducted studies on the growth of $Y_3Fe_5O_{12}$(YIG), which is used as a microwave device, by the floating zone method and the growth of $Y_3Al_5O_{12}$(YAG) by the pull method following the research procedures mentioned above. Model tests were also conducted by flux and hydrothermal methods in order to clarify the mechanism of crystal growth. This year's achievements are the establishment of a technique for single crystal growth of YIG containing Ga and Al, and the completion of a computer program written for the total shape control of YAG single crystal growth by an automated pull method, marking the end of the 5-year research project.

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REFER ALSO TO CITATION(S) 17947, 17948, 18086, 18095, 18095, 18097, 18098, 18102, 18102, 18104, 18105, 18126, 18169, 18173, 18184, 18269, 18282, 18283, 18287, 18288, 18295, 18352, 18352, 18866, 19031, 19031, 19105

18818 **(DOE/ER/05002—39) Detection of expansion at large angle grain boundaries using electron diffraction.** Balluffi, R.W.; Bristowe, P.D. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). Feb 1984. Contract AC02-78ER05002. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007889.

Lamarre and Sass (LS) (Scripta Metall. 17: 1141(1983)) observed a grain boundary electron diffraction effect from a large angle twist boundary which they claim can be used to obtain the volume expansion at the grain boundary in a direction normal to it. This paper considers the case where the intensity from the grain boundary region, is close to lattice reflections on the same element of the boundary diffraction lattice. Analysis of this complex problem show that the simplified model of LS is misleading in this case. (DLC)

18819 **(DOE/PC/60807—2) Supercritical fluid chromatography/supersonic jet spectroscopy. Progress report, November 1, 1983-January 31, 1984.** Lee, M.L.; Goates, S.R. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry). 1984. Contract FG22-83PC60807. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007364.

Modifications were made in the designs for the supercritical fluid extraction/fractionation unit and the vacuum chamber for supersonic jet spectroscopy. The construction of the extraction/fractionation unit is nearly complete and the construction of the vaccum system is presently underway. An interface has been constructed for supercritical fluid chromatography - mass spectrometry based on direct fluid injection with provision for circulating a heated liquid for precise temperature control. Initial experiments indicate effective transfer of the chromatographic effluent, and preservation of chromatographic efficiency. 1 reference, 4 figures.

18820 **(DP-MS—83-82) Wet chemical analysis with a laboratory robotic system.** Burkett, S.D.; Dyches, G.M.; Spencer, W.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 14p. (CONF-840304—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008187.

From 35. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (5 Mar 1984).

Emphasis on laboratory automation has increased in recent years. The desire to improve analytical reliability, increase productivity, and reduce exposure of personnel to hazardous materials has been fundamental to this increase. The Savannah River Laboratory (SRL) performs research and development on nuclear materials. Development of methods to increase efficiency and safety and to reduce exposure of personnel to radioactive materials is an ongoing process at our site. Robotic systems offer a potentially attractive way to achieve these goals.

18821 **(GAT-T—3184) Determination of trace impurities in uranium hexafluoride by an inductively coupled argon plasma spectrometer.** Short, B.W.; Spring, H.S.; Grant, R.L. (Goodyear Atomic Corp., Piketon, OH (USA). Chemical Analysis Dept.). 6 Jan 1983. Contract AC05-76OR00001. 8p. NTIS, PC A02/MF A01. Order Number DE83017980.

A procedure has been developed to determine 21 trace impurity elements in uranium hexafluoride, using inductively coupled argon plasma emission spectrometry (ICAP). The method consists of a liquid-liquid extraction to separate uranium from the trace impurities with a mixture of tri-(2-ethyl-hexyl)-phosphate (TEHP) and heptane. The raffinate containing the elements is subsequently analyzed by ICAP. The impurity elements which can be analyzed by

this method are: Al, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Na, Ni, Pb, Sb, Sn, Ti, V and Zn.

18822 **(GKSS—83/E/35) Bentonite-stabilized CDA/CTA membranes for seawater desalination. Pt. 1.** Finken, H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750748.

Active bentonite filters were incorporated into asymmetric CDA/CTA membranes applicable for one-stage seawater desalination. Their effects were examined by long-term RO test runs at 0,6 mol/l NaCl, 25°C and 80 bar: The decreases of permeate fluxes with time were lowered with increasing bentonite concentrations. The maximum product water out-put related to a test period of 1 year and a membrane area of 1 m^2 was achieved by the membranes with 1000 ppm bentonite. This enhanced flux stability was interpreted by means of a double-layer membrane model and a flux-time correlation derived from it as an improved mechanical stability of the porous substructure.

18823 **(IFUSP-P—393) X-ray fluorescence analysis of Fe, Mn, Cr and V in natural silicate crystals.** Dias, O.L.; Albuquerque, A.R.P.L.; Isotani, S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700083.

Concentrations of Fe, Mn, Cr and V were determined in samples of beryl, topaz, tourmaline and spodumene by measuring the first order K sub(α) fluorescence lines. The intensity of these lines were calibrated by using beryl as the standard matrix. The matrices were prepared in the form of pressed pellets with 4:1 mixture of beryl and boric acid, where transition metal oxides were added.

18824 **(KAERI/RR—353/82) Study on neutron activation analysis.** Kim, N.B.; Hong, K.B.; Lee, K.Y. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 61p. (In Korean). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700084.

In determining the contents of impurity elements in reactor materials using neutron activation analysis, methods for preconcentration and radiochemical separation have been studied. Before applying neutron irradiation boron impurity has been preconcentrated by a cation exchange separation method. After neutron irradiation the radiochemical separation method for the determination of 27 elements is based on a group separation using ion-exchange resin and mineral exchanger. The method has employed minerals acid or organic mixture of the acid, excluding hydrofluoric acid, as the media and common glass wares as the apparatus. This separation method was applied to the reactor materials such as copper alloy and zirconium alloy. The single comparator method was used for determining the content of each element separated radiochemically and the analytical results gave the statistical and systematic errors of less than 10% and 6.1% respectively. A prompt gamma-ray measurement method has been used for determining the content of the preconcentrated boron and the analytical results gave the statistical and systematic errors of 5.4% and 3.3 %, respectively.

18825 **(KFK—3351) Extractive phase distribution of uranyl nitrate with tri(n-butyl)phosphate. Pt. 1.** Kanellakopulos, B.; Dressler, P.; Ertel, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Apr 1983. 36p. (In German). (PWA—100/82). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750742.

The distribution coefficients of UO_2^{2+} in the system $UO_2(NO_3)_2$-TBP-H_2O-HNO_3 have been measured for small uranium concentrations (from 10^{-2} to 10^{-5} M/l) and for HNO_3 concentrations from 0.0 to 12.4 M/l in the aqueous phase.

18826 **(LA—9950-MS) Quality assurance for environmental analytical chemistry: 1982.** Gladney, E.S.; Burns, C.E.; Perrin, D.R.; Robinson, R.D. Knab, D. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008369.

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The continuing quality assurance effort by the Environmental Surveillance Group is presented. Changes in philosophy, methodology, and computing resources that have taken place since the first report in this series are documented. All quality assurance reference materials now in use, their certified or consensus concentrations, and all analytical chemistry quality assurance measurements made by HSE-8 during 1982 are included.

18827 **(LA-UR—84-711) Laser diagnostics of materials and chemistry.** Hartford, A. Jr. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 36p. (CONF-8404110—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007469.

From 4. international conference on high temperature science - HYTHERM; Santa Fe, NM, USA (2 Apr 1984).

Several examples are given of the ability of laser-based diagnostic techniques to make noninvasive measurements in hostile environments. Using coherent anti-Stokes Raman scattering both majority and minority species concentrations, as well as temperature, have been measured in the hot, high-pressure, particle-laden stream of a coal gasifier. In addition, numerous toxic and corrosive elements in the gasifier stream have been identified, but not yet quantified. In addition to providing the capability for making analytical determinations, laser techniques have been extensively employed to measure the rates of elementary chemical reactions. Recently, the temperature regime over which such meaurements are possible has been expanded. Although much of the laser diagnostic activity to date has involved investigations of the gas phase, significant information concerning heterogeneous phenomena can still be inferred. For instance, gas-solid reactions can manifest themselves as changes in vapor phase composition. Furthermore, in the future we expect expanded studies involving reactions of refractory metals (both atoms and clusters) and additional investigations of processes occurring at interfaces and on surfaces.

18828 **(MINTEK-M—53) Development of an automatic sample-changer and control instrumentation for isotope-source neutron-activation analysis.** Andeweg, A.H.; Watterson, J.I.W. (Council for Mineral Technology, Randburg (South Africa)). 15 Mar 1983. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700085.

An automatic sample-changer was developed at the Council for Mineral Technology for use in isotope-source neutron-activation analysis. Tests show that the sample-changer can transfer a sample of up to 3 kg in mass over a distance of 3 m within 5 s. In addition, instrumentation in the form of a three-stage sequential timer was developed to control the sequence of irradiation transfer and analysis.

18829 **(NRCN—499) Determination of kerosene in phosphoric acid by gas chromatography.** Levin, R.; Melloul, S.; Lapid, J. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). Oct 1982. 20p. (In Hebrew). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700086.

The development of a method for the determination of carried-over, and or soluble, kerosene in the stream of phosphoric acid used in the process of separation of uranium is described. The organic phase is injected into the gas-chromatograph after centrifugation. Several organic solvents were tested with different gas-chromatographic columns. The solvent chosen was carbon disulfide combined with a column filled with silicon oil DC 200 (0.5 v/w) on Haloport F. The limit of detection is 70 nanoliter of kerosene in 100 ml phosphoric acid. Amounts of 300-800 nl of kerosene could be measured with a precision of 5 percent. A precision of 1 percent is obtained for higher concentrations, providing that an upper layer

of kerosene is not formed. Separation of the kerosene layer lowers the precision of the method.

18830 **(PNL-SA—11455) Kinetic analysis of laser induced phosphorescence in uranyl phosphate for improved analytical measurements.** Bushaw, B.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 7p. (CONF-831025—30). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008287.

From 26. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (11 Oct 1983).

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Pulsed dye-laser excitation with multichannel scaler photon counting is used to obtain time resolved emission spectra of uranyl ions in aqueous solution. Kinetic analysis of this data corrects for matrix quenching and temperature effects which reduce the quantum yield of the uranyl ion luminescence. The method gives accurate measurements without separative prechemistry or the use of internal standards. Detection limits of one part-per-trillion (pptr) have been demonstrated, and in samples with concentrations greater than 100 pptr, relative standard deviations of less than 3% are achieved routinely.

18831 **(PNL-SA—11787) Supercritical fluid methods in analytical chemistry.** Smith, R.D.; Wright, B.W.; Udseth, H.R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1983. Contract AC06-76RL01830. 7p. (CONF-831025—31). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008289.

From 26. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (11 Oct 1983).

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Increasing the pressure of a supercritical fluid allows its properties to be varied continuously from those of a gas to those of a dense fluid with the solvating power of a liquid. The potential for improved chromatographic methods was recently realized using capillary columns suited for supercritical fluid chromatography. Supercritical fluids also offer distinct advantages for transport of thermally labile compounds to the mass spectrometer ion source.

18832 **(USGS-OFR—81-992) Selenium isotope analysis.** Webster, C.L. Jr.; Warren, C.G. (Geological Survey, Denver, CO (USA)). 1981. 21p. USGS Open File Service, Box 25425, Denver Federal Center, Denver, CO 80225.

The isotope ratio of selenium-80 to selenium-74 was determined on an isotope ratio mass spectrometer. Samples of 2 to 4 mg of selenium were fluorinated with CoF_3 in a small disposable copper bomb. The product, SeF_6, was purified in a vacuum line by distillation. The $^{80}Se/^{74}Se$ ratio was determined on a double-collector mass spectrometer that was modified to collect either ^{82}Se-^{80}Se or ^{80}Se-^{74}Se ion pairs. The standard deviation of the difference between two individually fluorinated samples was about 1 per mil. Because essentially all the error was associated with the fluorination step, comparisons between a standard of SeF_6 and individually fluorinated samples can be expected to have a standard deviation of about 0.5 per mil.

18833 (ZfI-Mitt—70, pp 114-121) **Apparatus for gamma activation analysis.** Pavlicsek, I.; Stenger, V.; Veres, A. (Magyar Tudomanyos Akademia, Budapest. Izotopintezete). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

An irradiation device containing 740 TBq (20,000 Ci) ^{60}Co giving 7.74 x 10^3 C/kg intensity (30 MR/h) and a pneumatic dispatch rabbit system controlled by an automatic system provided with an appropriate programme was built. The Se, Br, Sr, Ag, Cd, I, Hf, Ir, Au, and Pt content of samples of different origin can be determined in a volume of 5 cm^3 with 0.05 - 1 mg/g sensitivity.

18834 (ZfI-Mitt—70, pp 249-254) **Use of short-lived nuclides in activation analysis.** Ivanov, I.N.; Nikolaenko, O.K.; Pheoktistov, Yu.V.; Chulkin, V.L. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Radiatsionnoj Tekhniki, Moscow (USSR)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Main advantages of the analysis based on short-lived activity measurement are considered. Certain results in solving problems of activation analysis theory concerning short-lived nuclides are presented. Theoretical conclusions are applied in the process of designing the corresponding analytical devices.

18835 (ZfI-Mitt—70, pp 255-257) **Trace element determination in semiconductor selenium by neutron activation analysis.** Rudolph, K.P.; Flachowsky, J.; Lange, A. Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A chemical separation method is described for the matrix- and interfering element separation by neutron activation analysis of semiconductor selenium.

18836 (ZfI-Mitt—70, pp 295-305) **Possibilities of the direct gamma spectrometry in natural waters.** Manouchev, B.; Boschkova, T.; Tsankov, L.; Gurev, V.; Kojucharov, I.; Grozev, G. (Sofia Univ. (Bulgaria). Fizicheski Fakultet). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The direct gamma spectrometry in big volumes of natural waters is based on the progress of the experimental technique (high efficiency HP Ge detectors with good resolving power, small multichannel analyzers with automatic built-in option for the processing of the gamma spectra). It is possible to perform the absolute efficiency calibration of the detector system with a point gamma source. The results can be approximated with the theoretical dependence of the sensitivity on the energy which is derived using a spherical model of the detector. The shift in the energy calibration is reduced by splitting the total time into a number of short-time measurements, each of which is intercalibrated by the best photopeaks. A number of in situ measurements were carried out in Bulgaria and they showed the applicability of the method of direct gamma spectrometry of natural waters.

18837 (ZfI-Mitt—70, pp 324-334) **X-ray fluorescence analyzer of light elements with proportional scintillation counter.** Anders, N.A.; Isaev, V.S.; Filatov, V.I.; Kolesnikov, B.E.; Varvaritsa, V.P. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Radiatsionnoj Tekhniki, Moscow (USSR)); Mueller, D.; Morgenstern, P.; Riedel, W. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A multi-element radionuclide-excited X-ray fluorescence analyzer of light elements containing a gas proportional scintillation counter has been developed.

18838 **Mixed ligand chelate extraction of lanthanides with 1-phenyl-3-methyl-4-acyl-5-pyrazolones.** Sasaki, Y.; Freiser, H. (Univ. of Arizona, Tucson). *Inorganic Chemistry;* 22: No. 16, 2289-2292(3 Aug 1983).

A study of the equilibrium extraction behavior of series of representative tervalent lanthanide ions (La, Pr, Eu, and Yb) was caried out with either chloroform solutions of selected 1-phenyl-3-methyl-4-acyl-5-pyrazolones (acyl=decanoyl, phenacetyl, 3-phenylpropionyl, and p-tert-butylbenzoyl) (HP) alone or these solutions in combination with 1,10-phenanthroline (phen), trioctylphosphine oxide (TOPO), or methyltrioctylammonium chloride ($R_3R'NCl$). The results demonstrate that these lanthanides are extracted as LnP_3 or, in the presence of phen or TOPO, as LnP_3.phen or LnP_3.TOPO, or, in the presence of $R_3R'N^+Cl^-$, as $R_3RN^+LnP_4^-$. The extraction constants (K/sub ex/), K/sub ex/(phen), K/sub ex/(TOPO), and K/sub ex/, are discussed in terms of structure-behavior interrelations.

18839 New approach to the mass spectroscopy of non-volatile compounds. Torgerson, D.F.; Skowronski, R.P.; Macfarlane, R.D. (Texas A and M Univ., College Station). *Biochemical and Biophysical Research Communications;* **60**: No. 2, 616-621(1974).

A new method has been developed to obtain mass spectra of non-volatile compounds from the solid state at room temperature. Volatilization and chemical ionization of the sample are effected using a ^{252}Cf fission fragment source. Mass spectra are measured using a new time-of-flight mass spectrometer featuring single ion counting and fast electronics. Positive and negative ion mass spectra for the amino acids arginine and cystine which are characterized by intense quasi-molecular ions are presented. 3 figures.

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REFER ALSO TO CITATION(S) 18310, 18710, 18881

18840 (DOE/ER/04900—4) Studies of the hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1983-May 31, 1984. Adams, R.D. (Yale Univ., New Haven, CT (USA)). Feb 1984. Contract AC02-78ER04900. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009059.

We have recently discovered that triosmium clusters are very effective in producing carbon-sulfur bond cleavage reactions and are thus useful reagents for the desulfurization of a variety of sulfur containing small molecules including organic sulfides and thiols. During the past year we have expanded upon these studies and also discovered that some of the sulfido osmium carbonyl clusters that are formed are also effective in the activation of hydrogen. It is hoped that these sulfidometal carbonyl hydride compounds may be useful as catalysts for hydrogenation reactions.

18841 (DOE/ER/10981—2) Studies of elimination reactions of metal complexes. Technical report, August 1, 1983-July 31, 1984. DuBois, M.R. (Colorado Univ., Boulder (USA). Dept. of Chemistry). 1984. Contract AC02-81ER10981. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009373.

The bridging sulfido ligands in the complex $(C_5H_5MoS)_2S_2CH_2$ and related molybdenum dimers have been found to activate C-H bonds in certain alkenes and alkynes and to catalyze extensive H-D exchange in these molecules. Mechanistic features of these reactions are under investigation. Altering the nature and charge of the bridging ligands in these complexes results in significant shifts in the observed reduction potentials. The reactivity of the sulfido ligands can be tuned in this way to interact with a range of electrophiles and nucleophiles. The ability to alter reactivity should be useful in the development of new sulfur based catalytic chemistry. New dimeric complexes of vanadium, tungsten, rhenium, and iron with bridging sulfido ligands have also been synthesized and characterized. The sulfur ligands in some of the tungsten complexes appear to react readily with hydrogen despite the fact that they are in a different electronic and structural environment than the reactive ligands in the molybdenum systems. Vanadium dimers which are isostructural with the molybdenum complexes show no evidence for reactivity.

18842 (DOE/ET/00082—T1) Solar energy in an alternative method for nitrate production. Final report. Harteck, P. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemistry). Dec 1982. Contract FG02-79ET00082. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008235.

Portions are illegible in microfiche products.

Air can be used, in principle, as a source of nitrogen to produce nitrates for fertilizer. This direct production, has been inefficient and expensive because of the very high temperatures, generally needed. A new method has been proposed and experiments performed. Using a metal oxide in contact with the air, in the temperature range of ~ 450 to 650°C and a pressure in the region of one to 100 atmospheres, the oxide can react with the nitrogen oxides as they are formed, and thereby produce nitrates continuously. The yield is not only high, but in general the overall processes are exothermic. The temperature must be high enough to form nitrogen oxides at a rapid rate, while at the same time low enough to avoid dissociation of the nitrates. The dissociation pressure of the nitrate rises very rapidly with temperature. Most of the work reported here has focused on a search for a catalyst which would provide a sufficiently rapid rate of formation of the nitrogen oxides to make the process practical. One commercially available catalyst has been found which gives significantly enhanced nitrogen oxide production. The addition of water vapor, however, was important to provide stable continuous and even more rapid catalytic behavior. The results appear favorable, but work is needed, especially at high pressures, since the current work was mainly between one and three atmospheres and a few at 100 atmospheres. The development of an alternative method of fertilizer production is desired because of the growing energy problem and the limitations which will be placed on natural gas use; currently natural gas is used in large quantities in the United States for the production of nitrate fertilizers. In addition the growing world population will aggravate the food supply problem and more fertilizers will, if anything, be in demand than at any time in history.

18843 (IS-T—1110) Homo- and heteropolyatomic anions of the post-transition elements of Group IV and V: synthesis and crystal structure characterization. Critchlow, S.C. (Ames Lab., IA (USA)). Jan 1983. Contract W-7405-ENG-82. 165p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84007196.

Thesis.

Polyatomic anions of the group IV and V post-transition elements can be isolated as stable salts by the reaction in ethylenediamine (en) of alkali metal alloys with crypt. KSnBi or KPbSb react to form black pseudohexagonal $(2,2,2\text{-crypt-}K^+)_2^-Sn_2Bi_2^{2-}$.en or $(2,2,2\text{-crypt-}K^+)_2Pb_2Sb_2^{2-}$.en. The $Sn_2Bi_2^{2-}$ and $Pb_2Sb_2^{2-}$ anions have tetrahedral geometries. The similar reaction of KGeSb, KPbSb or KAuSb produces bluish-black crystals of $(2,2,2\text{-crypt-}K^+)_2Sb_4^{2-}$. The Sb_4^{2-} anion is square planar (D_4/sub h/). The KGeSb reaction also produces dark-red triclinic $(2,2,2\text{-crypt-}K^+)_3Sb_7^{3-}$.2en. The Sb_7^{3-} anion has approximately C_3/sub v/ symmetry. The alloy composition KSn_2 reacts to form reddish-black triclinic $(2,2,2\text{-crypt-}K^+)_3Sn_9^{3-}$.1.5en. With 21 skeletal electrons, the new Sn_9^{3-} anion is paramagnetic. The cluster configuration is tricapped trigonal prismatic (D_3/sub h/) with a height to edge ratio of 1.08. This trend is consistent with extended Hueckel MO calculations. These findings provide a direct explanation for the anomalous closo configuration of the (2n+4)-electron Bi_9^{5+} ion. Partial crystal structure results for the disordered compounds $(2,2,2\text{-crypt-}Na^+)_2Ge_4^{2-}$ and $(2,1,1\text{-crypt-}Li^+)_4Sn_9^{4-}$ are also reported.

18844 (KAERI/RR—377/82, pp 1-45) Water chemistry of PWR power plant. Yang, J.C.; Yang, K.R.; Lee, I.C.; Kang, H.D.; Cho, S.W.; Whang, C.K. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A17/MF A01.

In Controls of radioactivity by hydrogen peroxide in reactor coolant system.

A dissolution study of cobalt oxides in boric acid solution containing hydrogen peroxide has been carried out at 60degC. The ionic species produced when the cobalt oxides is dissolved by hydrogen peroxide is likely to be $HCoO_2$- and its conversion to Co_2O_3 by oxidation of dissolved oxygen was observed.

18845 (LA—9987) Recommendations for plutonium colloid size determination. Kosiewicz, S.T. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008371.

This report presents recommendations for plutonium colloid size determination and summarizes a literature review, discussions with other researchers, and comments from equipment manufacturers. Four techniques suitable for plutonium colloid size characterization are filtration and ultrafiltration, gel permeation chromatography, diffusion methods, and high-pressure liquid chromatography (conditionally). Our findings include the following: (1) Filtration and ultrafiltration should be the first methods used for plutonium colloid size determination because they can provide the most rapid results with the least complicated experimental arrangement. (2)

After expertise has been obtained with filtering, gel permeation chromatography should be incorporated into the colloid size determination program. (3) Diffusion methods can be used next. (4) High-pressure liquid chromatography will be suitable after appropriate columns are available. A plutonium colloid size characterization program with filtration/ultrafiltration and gel permeation chromatography has been initiated.

18846 **(LBL—17223) Chemical modification of surfaces: the effect of potassium on the chemisorption of molecules on transition metal crystal surfaces.** Crowell, J.E. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 287p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84008345.

Portions are illegible in microfiche products; Thesis.

The physical and chemical properties of pure potassium monolayers and its effect on the adsorption of oxygen, carbon monoxide and benzene on the (111) faces of platinum and rhodium single crystals are described. Potassium adsorption on both surfaces is quite similar. Potassium forms hexagonally close packed structures that are incommensurate with the substrate. The heat of desorption of potassium on these surfaces decreases with increasing potassium coverage. The surface free electron density increases and the work function decreases substantially wtih alkali adsorption, indicating charge transfer occurs from potassium to the substrate. Oxygen adsorption increases the potassium binding energy, and forms a surface complex at high potassium coverages. Oxygen adsorption is dissociative on both clean and potassium dosed Rh(111). The metal-oxygen stretching vibration increases in the presence of potassium, indicating stronger adsorption. Carbon monoxide adsorption on both metal surfaces is strongly affected. With increasing potassium coverage, the heat of desorption increases while the C-O stretching frequencies decrease. Also, substantial population shifts from the atop to the bridged site occur. Dissociation of CO is induced on Rh(111) by the presence of potassium. Benzene is found to be π bonded oriented with the ring plane parallel to the surface with C/sub 3v/(σ/sub d/) symmetry on both the clean and potassium dosed Rh(111) surfaces. Potassium reduces the heat of desorption of molecular benzene and induces a lower temperature pathway to decomposition. The major influence of potassium is to increase the surface electron density, which, for molecular adsorbates with low lying vacant orbitals of the correct symmetry, can lead to substantial changes in their bonding with the surface.

18847 **Ligand-exchange reactivity patterns of oxotechnetium(V) complexes.** DePamphilis, B.V. (Harvard Medical School and Brigham and Women's Hospital, Boston, MA); Jones, A.G.; Davison, A. *Inorganic Chemistry;* **22**: No. 16, 2292-2297(3 Aug 1983). Contract AC02-76EV04115.

The ligand-exchange reactions of various oxotechnetium(V) complexes with 1,2-dithiols have been investigated. The complexes $[TcO(OCH_2CH_2O)_2]^-$ (1), $[TcO(O_2C_6H_4)_2]^-$ (2), and $[TcO(SCH_2CH_2O)_2]^-$ (3) all react with 2 equiv of 1,2-ethanedithiol to ultimately form $[TcO(SCH_2CH_2S)_2]^-$ (4). However, different mechanisms and/or intermediates are observed in each case. The reaction of 1 proceeds without evidence for the formation of intermediates. In the reaction of 2, an intermediate is detected, which is probably a mixed-ligand oxotechnetium monomer; and in the reaction of 3 the spectrum of the intermediate formed is similar to that of the dimer species $[(TcO)_2(SCH_2CH_2S)_3]$ (5). The relation of these results to ligand-exchange reactions of 1,2-dithiols with citrate complexes of technetium is discussed. Reaction of 1,3-propanedithiol with $[TcOCl_4]^-$ gives a compond formulated as $[(TcO)_2(SCH_2CH_2CH_2S)_3]$, which does not react with further amounts of ligand to form the bis(1,3-dithiolato) monomer, as would be anticipated from the sequential formation of 4 from 5 in the reacton of $[TcOCl_4]^-$ with 1,2-ethanedithiol.

18848 **Second dissociation constant of hydrogen sulfide.** Meyer, B. (Univ. of California, Berkeley). *Inorganic Chemistry;* **22**: No. 16, 2345-2346(3 Aug 1983). Contract AC03-76SF00098.

Published values for the pK/sub a/$_2$ values of hydrogen sulfide cover a range of almost 8 orders of magnitude. In this study a Raman spectrometric method is used for in situ identification of the H-S stretch in high-ph solutions and for estimating their concenrations. The data presented here yield a pK/sub a/$_2$ value of 17 +\- 1.0, the highest value yet reported. This value is consistent with the higher limit reported by the UV method. A review of old literature shows that high pK/sub a/$_2$ values were already postulated more than 50 years ago by Wasastjerna, who proposed a value of 6 x 10^{-17}, and by Aumeras, who used the solubility data for cadmium sulfide to derive a value of 3.6 x 10^{-16}. Both of these values are consistent with our value. Our value is also consistent with the value obtained by Brewer on the basis of a thorough review of current thermodynamic data.

18849 **Reactivity of $Pt(PCy_3)_2$ and $Pt[P(t\text{-}Bu)_3]_2$ with SO_2 and CS_2.** Ritchey, J.M.; Moody, D.C.; Ryan, R.R. (Los Alamos National Lab., Univ. of California, NM). *Inorganic Chemistry;* **22**: No. 16, 2276-2280(3 Aug 1983).

The first structurally characterized three-coordinate bis(phosphine)platinum(O)-sulfur dioxide complex is described, $Pt(PCy_3)_2SO_2$. The complex crystallized in the monoclinic space group C2/c with a = 23.328 (4) angstrom, b = 15.181 (3) angstrom, c = 25.207 (4) angstrom, and β = 126.17 (1)° with Z = 8 (T = -100Γ). The effect of subtle electronic and steric changes on the reactivity of $Pt(PCy_3)_2$ and $Pt[t\text{-}Bu)_3]_2$ with the small molecules SO_2, CS_2, and O_2 is demonstrated. Evidence is presented for the first example of a bridged $Pt_3(\mu\text{-}CS_2)_3(PR_3)_3$ moiety.

18850 **Raman spectra of the rare earth trimetaphosphates.** Begun, G.M.; Bamberger, C.E. (Oak Ridge National Lab., TN). *Journal of Raman Spectroscopy;* **13**: No. 3, 284-289(1982). Contract W-7405-ENG-26.

Raman spectra of anhydrous crystalline powders of all the lanthanide trimetaphosphates (with the exception of $Pm(PO_3)_3$) and of yttrium trimetaphosphate have been obtained. These data have been interpreted in a systematic manner based on the known structures of these compounds. Variations of the vibrational band frequencies with atomic number are much less than with the orthophosphates. 6 figures, 2 tables.

18851 **Raman spectra of the rare earth trimetaphosphates.** Begun, G.M.; Bamberger, C.E. (Oak Ridge National Lab., TN). *Journal of Raman Spectroscopy;* **13**: No. 3, 284-289(1982). Contract W-7405-ENG-26.

Raman spectra of anhydrous crystalline powders of all the lanthanide trimetaphosphates (with the exception of $Pm(PO_3)_3$) and of yttrium trimetaphosphate have been obtained. These data have been interpreted in a systematic manner based on the known structures of these compounds. Variations of the vibrational band frequencies with atomic number are much less than with the orthophosphates. 6 figures, 2 tables.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 18352, 18710, 18840

18852 **(IS-T—1111) Characterization and chemistry of vinylketene prepared by flash vacuum pyrolysis. Study of the flash vacuum pyrolysis of hydraomatic compounds: 5,8-diphenyltetralin and the parent and substituted 5,6,11,12-tetrahydrodibenzo(a,e)cyclooctenes.** Surber, B.W. (Ames Lab., IA (USA)). Jan 1984. Contract W-7405-ENG-82. 181p. NTIS, PC A09/MF A01; GPO Dep. Order Number DE84007200.

Thesis.

Benzocyclobutene and its [4+4] dimer, 1,5-dibenzocyclooctadiene were found to give anthracene (7) as a major product. The similarity of the product mixtures is taken as evidence that essentially the same mechanism is operating in both cases. By labeling studies, the [4+2] spirodimer (14') appears to be an intermediate. The fragmentation by which 14' is thought to give 7 is new and analaogous to the retroene reaction. Vinylketene, prepared by FVP, was characerized by low-temperature ^{1}H- and ^{13}C-NMR spectroscopy. It was found to dimerize by a novel [4+2] cyclo-addition reaction. The resulting δ-lactone was isomerized to a mixture of **sibirinone** (91) and 6-allyl-α-pyrone. Acid-catalyzed isomeriza-

tion gave primarily 91 (9:1 mole ratio). When vinylketene was mixed with cyclopentadiene, the [2+2] cycloadduct (72) was formed with high regio- and stereospecificity. Compound 72 was isomerized to bicyclo[4.2.1]nona-3,7-dien-2-one. Part III described an attempt to determine the effect of surface catalysis in FVP. The synthesis of 5,8-diphenyltetralin (9) was described. Comparison of the pyrolysis of 9 to that of the parent pound, tetralin (1) was not possible. The major product of the pyrolysis of 9 at 1000°C and 10^{-5} torr was due to the loss of C_2H_6 while 1 gave styrene as the major product by the loss of C_2H_4.

18853 (Juel—1850) Lattice dynamics of imidazole. Link, K.H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Dortmund Univ. (Germany, F.R.)). May 1983. 129p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750893.

The lattice dynamics of imidazole have been investigated. To this end dispersion curves have been determined at 10 K by inelastic coherent neutron scattering. RAMAN measurements have been done to investigate identical gamma - point modes. The combination of extinction rules for RAMAN - and neutron scattering leads to the symmetry assignment of identical gamma - point modes. The experiment yields a force constant of the streching vibration of the hydrogen bond of 0.33 mdyn/A. A force model has been developed to describe the intermolecular atom - atom Interactions in imidazole.

18854 Benzophenone reduction using sulphur-based additives. Stenberg, V.I.; Baltisberger, R.J.; Kundson, C.L.; Wettlaufel, D.; Woolsey, N.F. (Department of Chemistry, University of North Dakota, Grand Forks, ND). *Fuel;* **62**: No. 10, 1234-1235(Oct 1983).

Pyrite and γ-Fe_2S_3 are the best of the mineral promotors tried for the CO-H_2O reduction of benzophenone to diphenylmethane. A mixture of ferrous sulphide and sulphur matches the promotional effect of iron pyrite, which implies that sulphur plays a role in the reaction. Both elemental sulphur and hydrogen sulphide are shown to promote CO-H_2O-induced reductions.

18855 Dealkylation of N,N-dimethylaniline with sulphur and hydrogen sulphide. Stenberg, V.I.; Baltisberger, R.J.; Srinivas, V.R.; Sweeny, P.; Woolsey, N.F. (Department of Chemistry, University of North Dakota, Grand Forks, ND). *Fuel;* **62**: No. 8, 913-915(Aug 1983). Contract AB18-80FC10120;AC01-76ET10516.

N,N-Dimethylaniline successively demethylates at 425°C in the presence of hydrogen and hydrogen sulphide or sulphur to give successively N-methylaniline and aniline. For the dealkylation reaction, the rank order of promotors is $S > S\text{--}H_2 > H_2S\text{--}H_2 > H_2$.

18856 Activated metallic nickel as a reagent for the dehalogenative coupling of halobenzenes. Matsumoto, H.; Inaba, S.; Rieke, R.D. (Univ. of Nebraska, Lincoln). *Journal of Organic Chemistry;* **48**: No. 6, 840-843(25 Mar 1983). Contract AC02-80ER10603.

Activated metallic nickel powder, prepared by the reduction of nickel halides with lithium and with naphthalene as an electron carrier, is a simple and a convenient reagent for the dehalogenative coupling of iodobenzenes and bromobenzenes under mild conditions. The intermediates, ArNiX and Ar_2Ni species (Ar = C_6F_5), were isolated as the phosphine complexes.

18857 Ionization energy correlations for alkyl-substituted chromophores. Hochmann, P. (Univ. of Texas, San Antonio); McGlynn, S.P.; Findley, G.L. *International Journal of Quantum Chemistry, Quantum Biology Symposium;* **9**: 173-179(1982). Contract AS05-76EV03018.

A correlation algorithm for ionization potentials of alkylated molecules is presented and tested. This algorithm treats the situation in which the chromophore X is held constant while the substituent S is varied, it provides an expression for the ionization potential as a function of substituent molecular parameters, and it gives a faithful representation of the experiment. A very concise derivation of the correlative equations is also presented. This derivation follows from the imposition of specified model assumptions upon the superposition of Koopmans' theorem and the antisymmetrized molecular spin-orbital approximation.

18858 Raman spectrometric study of the thermal decomposition of aqueous tri- and tetrathionate. Meyer, B. (Univ. of Washington, Seattle); Ospina, M. *Phosphorus and Sulfur and the Related Elements;* **14**: 23-36(1982). Contract AC03-76SF00098.

The decomposition of 0.25 M trithionate and 0.5 M tetrathionate was followed at 20, 35, 50 and 70°C. During the reaction tri- and tetrathionate interconvert. Thiosulfate is observed as a prominent intermediate. The end products are elemental sulfur, sulfate, disulfite and bisulfite. The decomposition of trithionate follows a first order reaction with a rate constant of 1.4×10^{-1} at 70°C. In tetrathionate the reaction is preceded by an induction period and is second order, with a rate constant of 4×10^{-3} at 20°C. In both systems sulfate is formed in a first order reaction with a rate constant of 3.1×10^{-3} hrs^{-1} at 20°C. The decomposition mechanism in both systems involves the hydrolysis of trithionate. 9 figures, 3 tables.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 18122

18859 (DOE/ER/04445—T3) Activity and diffusivity of lithium intercalated in graphite. Agarwal, R.R. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemical Engineering). Dec 1982. Contract AC02-77ER04445. 198p. NTIS, PC A09/MF A01; 1; GPO Dep. Order Number DE84008204.

Portions are illegible in microfiche products; Thesis.

Using a sufficiently sensitive coulometric technique it has been possible, for the first time, to generate electrochemically the potential plateaus for the various lithium intercalation compounds, viz. $C_{64}Li$, $C_{32}Li$, $C_{18}Li$ and $C_{12}Li$; up to a composition of $C_{7.28}Li$. These experiments were carried out in a LiCl-KCl eutectic between 400 to 600°C, and in a rigorously purified perfectly argon atmosphere. Lithium activity and diffusivity values in graphite were determined as a function of composition and temperature. Thus, the lithium activity is 6.832×10^{-2} (or 173 mV versus lithium) for $C_{16.80}Li$ at 475°C. The lithium diffusivity into the two-dimensional host graphite is very rapid (10^{-4} to 10^{-7} cm^2/s), i.e., comparable to the highest values observed in three-dimensional solids. Other thermodynamic quantities and diffusion activation energies have also been calculated for the above stoichiometric intercalation compounds. The intercalation process appears to be affected significantly by temperature-related structure changes of the host graphite. This was evident from the temperature dependence of coloration, activity and diffusivity during the lithium intercalation. In the synthetic graphite used, the breaking-up of rogue bonds appears to be a key step in the staging of intercalation. Further experiments and structural studies are needed to verify this.

18860 (NP—4770166) Treatise on the realization of the alkali medium temperature, medium pressure water electrolysis. Hofmann, H. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physikalische Chemie und Chemische Technologie). 2 Feb 1981. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770166.

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To improve the efficiency of the alkali water electrolysis, it is proposed to raise the working temperature to almost 200°C. This means working under raised operational pressure. Both of these have a positive effect on the electrical energy consumption. The raised temperature improves the specific, electrical conductivity of the electrolyte, reduces the separation excess voltage of the product gases and enables, at any rate for small current densities, to lower the cell voltage below the value of the thermoneutral voltage. The use of electrocatalysts for the oxygen formation together with the above mentioned measures and the optimization of the anode/diaphragm/cathode arrangement enables electrolyses to be performed at temperatures of 175-185°C and pressures of 30 to 40 bar with a current density of 1 A/cm^2 and cell voltages of 1.52-1.58 V. A new oxide ceramic diaphragm was developed with metallic supporting tissue sintered into it. The diaphragm can be manufactured at 0.4

and 0.2 mm thickness. The proved to be stable in electrolyses of up to 500 h durations at 200°C in 50 wt.% KOH electrolytes and fulfilled the requirements of high gas separation and low surface specific, electrical resistance.

18861 **(NP—4770167) Analysis of the Al/Br_2 system as basis for an electrochemical energy storer.** Scheffler, I. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Fachbereich Biologie und Chemie). 1 Dec 1982. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84770167.

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The chances to realize the Alvertical strokeAlBr_3-LiBrvertical strokeBr_2 system as electrochemical energy storer were assessed with the test results of delta voltage measurements, galvanostatic measurements, as well as impedence measurements, using a model battery. This single cell Alvertical strokeBr_2 battery is characterized by an energy content of 240 wxh/kg (relative to the whole battery mass), a power content of 19 W/kg and a cell voltage of 1.55 V at I=0. Compared with conventional and future systems it comes into the top group. Problems such as the question of suitable sealing materials, the dedentric aluminium separation or the diaphragm as diffusion barrier for bromine, can be solved by further development work.

4005 Photochemistry

REFER ALSO TO CITATION(S) 18342, 18343, 18867, 18868, 18869

18862 **(DOE/ER/10545—1) Enhanced solar energy collection in porphyrin based photoconversion schemes. Final technical report.** Gust, D.; Moore, T.A. (Arizona State Univ., Tempe (USA). Dept. of Chemistry). Feb 1983. Contract FG02-79ER10545. 35p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84006882.

These studies involved preparation of a series of carotenoporphyrins whose conformations varied from folded (with the carotenoid π-electron system stacked over that of the porphyrin) to extended (with the two chromophores widely separated). The conformations were determined with the aid of high-resolution proton NMR studies. Laser flash spectroscopic studies revealed triplet energy transfer from porphyrin to carotenoid. Three distinct pathways for such transfer (presumably occurring via an electron exchange mechanism) were discovered. (1) Static through-space transfer which does not require significant intramolecular motions. (2) Dynamic through-space transfer mediated by intramolecular motions. (3) Triplet transfer mediated by the chemical bonds joining the chromophores. In addition, pulse radiolysis and fluorescence quenching studies of these ethers and related carotenoporphyrins yielded information concerning electron transfer in these systems. This work has demonstrated that the natural carotenoid functions of photoprotection from singlet oxygen damage and antenna function can be mimicked by synthetic molecules, and therefore in principle can be applied to artificial solar energy conversion systems.

18863 **(IS-T—1076) Mode-to-mode vibrational energy transfer in $^1B_2$ aniline induced by collisions with CO_2.** (Ames Lab., IA (USA)). Jan 1984. Contract W-7405-ENG-82. 128p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84007197.

Portions are illegible in microfiche products; Thesis.

Single vibronic level fluorescence spectroscopy was used to study intramolecular vibrational energy transfer in low pressure gas samples of $^1B_2$ aniline induced by collisions with CO_2. Vibrational energy transfer was traced from the O^0 vibronic level to eight growth levels. Collision-induced energy transfer for CO_2 as the collision gas was seen to follow a flow pattern similar to the pathways found previously for energy transfer in S_1 aniline with other collision partners. The magnitude of the normalized mode-to-mode energy transfer rate constants for each collision partner were found to vary roughly in proportion to the overall collision induced decay rate of the O^0 level for each system.

18864 **(SAND—83-2444C) Photodegradation of methyl salicylate in poly(methylmethacrylate).** Renschler, C.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 27p. (CONF-8404110—2). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007887.

From 4. international conference on high temperature science - HYTHERM; Santa Fe, NM, USA (2 Apr 1984).

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Methyl salicylate (MS) has been found to undergo photo-induced decarboxylation to form phenol. The process is first order and has a reaction quantum yield of ca. 8×10^{-5} and an activation energy of 1.2 kcal./mol (5.0 kJ/mol). Kinetic data were used in computer simulations of photodegradation of MS in poly(methylmethacrylate) (PMMA) solar lenses. It was predicted that typical MS concentrations would provide effective uv screening protection for less than 2 years.

18865 **Environmental influences on the photooxidation of manganese by a zinc porphyrin sensitizer.** Wohlgemuth, R.; Otvos, J.W.; Calvin, M. (Univ. of California, Berkeley). *Proceedings of the National Academy of Sciences of the United States of America;* **79**: 5111-5114(Aug 1982). Contract AC03-76SF00098.

The photosensitized oxidation of a membrane-bound Mn(III) tetrapyridylporphyrin derivative by a Zn tetrapyridylporphyrin derivative, which is confined to the membrane, has been achieved in negatively charged membranes consisting of phosphatidylglycerol or phosphatidic acid. At the same time, the zwitterionic electron acceptor, propylviologen sulfonate (PVS°), is reduced in the aqueous phase. The same reaction cannot be obtained with zwitterionic or cationic membranes, nor does this photosensitized reaction take place in a homogeneous solution with Mn(III) tetrapyridylporphyrin and Zn tetrapyridylporphyrin. These results show that the organization of donor, sensitizer, and acceptor at an appropriately selected interface allows reactions that would not occur in homogeneous solutions. 6 figures.

18866 **Doppler-limited spectrum and analysis of the $3\nu_3$ manifold of SiF_4.** Patterson, C.W. (Los Alamos National Lab., NM); Pine, A.S. *Journal of Molecular Spectroscopy;* **96**: 404-421(1982).

The two infrared-active vibrational bands of the $3\nu_3$ manifold of SiF_4 were recorded at T ~ 155 K with Doppler-limited resolution using a tunable laser difference-frequency spectrometer. Although all branches of the $l = 1$ band were seen, only portions of the P branch of the weaker $l = 3$ band were recorded. Some 192 lines with $J \leqq 36$ have been fitted to a model Hamiltonian which allows the $l = 1$ and $l = 3$ bands to interact. This analysis allows us to determine the effective harmonic frequency, $\omega_3{}^0$, and the three anharmonic coefficients X_{33}, G_{33}, and T_{33} with high precision, so that the vibrational levels in the $n\nu_3$ ladder can be predicted accurately for several values of n. In contrast with SF_6, the l basis is found to be the best representation for the vibrational sublevels. 12 figures, 3 tables.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 17978, 18181

18867 **(BNL—34474) Chemical and kinetic properties of HO_2/O_2^- in aqueous solutions.** Bielski, B.H.J. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 9p. (CONF-840489—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007694.

From Gas-liquid chemistry of natural waters conference; Upton, NY, USA (1 Apr 1984).

The two most important properties of the HO_2/O_2^- radical pair (perhydroxyl radical/superoxide radical) in aqueous solutions are that they are in a pH-dependent equilibrium with each other, and that they disproportionate by a second-order process at a rate tht varies with pH. This paper reviews methods for generation of HO_2/O_2^- radicals, their disproportionation, methods of detection, and their chemical reactivity. 35 references.

18868 (DOE/ER/00038—2517) Radiation Laboratory, University of Notre Dame. Quarterly report, July 1-September 30, 1983. (Notre Dame Univ., IN (USA). Radiation Lab.). 21 Feb 1984. Contract AC02-76ER00038. 44p. (NDRL—2517). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007396.

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Sixty abstracts are presented in the fields of radiation chemistry, photochemistry, and physical chemistry.

18869 (DOE/ER/00038—2537) Radiation Laboratory. Quarterly report, October 1, 1983-December 31, 1983. (Notre Dame Univ., IN (USA). Radiation Lab.). 23 Feb 1984. Contract AC02-76ER00038. 41p. (NDRL—2537). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009058.

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Fifty-seven abstracts are presented of research in the following fields: photochemistry, radical reactions, radiation chemistry, and chemistry. (DLC)

18870 (JAERI—1281) Radiation chemical studies on the treatment of waste water. Sakumoto, Akihisa; Miyata, Teijiro; Arai, Michimasa; Arai, Hidehiko. (Japan Atomic Energy Research Inst., Tokyo). Oct 1982. 40p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700088.

The radiation induced reaction in aqueous solution was studied to develope the radiation treatment as a new technique for waste water and to elevate the effectiveness of radiation. The effectiveness of radiation was enhanced by combination of radiation induced reaction with conventional methods such as biological treatment and coagulation treatment. The synergistic effect of radiation and ozone was studied by using phenol and ethylene glycol. The chain reaction was observed in the radiation induced oxidation. The combination of radiation and ozone is considered to be one of the most useful methods. In this report, the mechanism of each reaction and the applicability of the reaction to the treatment of waste water are discussed.

18871 Calculated ionization distributions in small volumes in liquid water irradiated by protons. Hamm, R.N.; Turner, J.E.; Wright, H.A.; Ritchie, R.H. (Oak Ridge National Lab., TN). *Radiation Research;* **97**: No. 1, 16-24(Jan 1984). Contract W-7405-ENG-26.

Monte Carlo calculations are made of the distributions of the number of ionizatons in small cylindrical and spherical volumes in liquid water irradiated by 3-MeV protons. Comparison with analogous, independent calculations for the vapor show expected differences attributable to the different states of condensation. In addition to several comparisons, detailed results for the liquid are presented for protons that pass through or near the volumes.

18872 Pulse radiolysis studies of californium(III) in aqueous perchlorate solution. Evidence for the preparation of californium(II). Sullivan, J.C.; Morss, L.R.; Schmidt, K.H.; Mulac, W.A.; Gordon, S. (Argonne National Laboratory, IL). *Inorganic Chemistry;* **22**: No. 16, 2338-2339(3 Aug 1983). Contract W-31-109-ENG-38.

Evidence for the production of the hitherto undescribed aqueous oxidation state Cf(II) and the results of attempts to prepare Cf(IV) by pulse radiolysis techniques is presented. There has been a previous report of the preparation of Cf(IV) in aqueous solutions of potassium phosphotungstate. The absorption spectrum of the Cf(IV) prepared in this medium has a broad band that extends from ~ 1000 nm and increases to 390 nm, the limit of the reported observation. This is not consistent with the spectral results obtained. In addition, the values for the estimted potentials of OH as an oxidant (2.65V) and that for the Cf(IV)/Cf(III) couple (3.2V) are not consistent with the preparation of Cf(IV) via OH oxidation.

18873 Electron spin echo envelope modulation of trapped radicals in disordered glassy systems. Dikanov, S.A. (AN SSSR, Novosibirsk. Inst. Khimicheskoj Kinetiki i Gorenіya). pp vp of Proceedings of the 5th 'Tihany' symposium on radiation chemistry held at Siofok, 19 - 24 Sep 1982. Budapest, Hungary; Mueszaki es Termeszettudomanyi Egyesueletek Szoevetsege (1982). (CONF-8209164—Summ.).

From 5. Tihany symposium on radiation chemistry; Siofok, Hungary (19 Sep 1982).

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 18167, 19157

18874 (PB—84-124833) Treatment of reactive wastes at hazardous waste landfills. Final report, October 1983-December 19822. Shooter, D.; Ong, J.H.; Preston, A.; Ehrenfeld, J.R. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Nov 1983. 74p. NTIS, PC A04/MF A01.

This report is intended to provide an information base for personnel accepting hazardous waste at existing disposal sites, or performing remedial action at uncontrolled waste sites, to make the appropriate decisions regarding the disposition of reactive wastes. It emphasizes simple treatment and disposal schemes which are likely to be the most cost effective. It provides information on the hazards to be anticipated and the appropriate safety precautions necessary to protect personnel and property and to prevent any further environmental damage. The data in this report was obtained by reviewing the extensive in-house background information on the characteristics of reactive hazardous wastes; by reviewing the recent literature, particularly information pertaining to the handling and treatment of hazardous chemicals and finally by seeking information and comment from operators of hazardous waste disposal sites, including those specializing in the handling of reactive wastes. The report is divided into three major sections: (1) Identification of Problem Wastes; (2) Identification of Treatment Alternatives; and (3) Identification of Data Gaps. Additional information on classes of chemical reactive wastes and treatment and disposal method identified from the literature, which were used to develop the more generalized schemes, is provided in Appendices A and B, respectively. Conclusions and Recommendations are summarized separately.

18875 (ZfK—493) Investigation on chemistry of model compounds of technetium radiopharmaceuticals. Muenze, R. (ed.); Bechstein, J.; Grossmann, B.; Hoffmann, J.; Johannsen, B.; Mocker, D.; Noll, B.; Seifert, S.; Spies, H.; Syhre, R. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jan 1983. 153p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84700087.

The report summarized experimental and theoretical results concerning the chemical structures and the biodistribution of hydrophilic technetium chelates with hydroxycarboxylic and aminopolycarboxylic acids, thiol compounds and aliphatic and aromatic nitrogen compounds as ligands. Methods which are suitable for synthesizing and characterizing defined chelates of Tc(V), Tc(IV) and Tc(III) have been developed for crystlline substances and species in solution, respectively. For certain types of technetium chelates three dimensional structure models were calculated from atomic parameters. The electron energies and electron distribution of Tc(V) thiol compounds were calculated by quantum chemical methods in order to interprete physical properties of these substances. Biodistribution studies revealed relationships between the osteotropic behaviour and the structure of phosphorous and non-phosphorous technetium chelates and between the kidney uptake and ligand exchange ability of Tc(V) hydroxycarboxylates. Important parameters for the production of technetium-99m kits have been elaborated and used for the optimization of radiopharmaceuticals (bone-, kidney and hepatobiliaer agents).

18876 Synthesis of (^{18}F)perchloryl fluoride and its reactions with functionalized aryl lithiums. Ehrenkaufer, R.E.; MacGregor, R.R. (Michigan Univ. Hospitals, Ann Arbor (USA). Div. of Nuclear Medicine; Brookhaven National Lab., Upton, NY (USA)). *International Journal of Applied Radiation and Isotopes;* **34**: No. 3, 613-615(Mar 1983).

[^{18}F]Perchloryl fluoride ($^{18}FClO_3$) has been synthesized by the reaction of [^{18}F]F_2 with $KClO_3$ and its synthetic utility demonstrated by the successful syntheses of [^{18}F] labeled 2-fluoroaniline, 2-fluoroanisole, 2-fluorobenzaldehyde and 3-fluoroveratrole by reaction with their respective ortho-lithiated aromatic precursors in 24, 34, 3 and 21% yields, respectively.

18877 Solubility of uranium(IV) hydrous oxide in sodium hydroxide solutions under reducing conditions. Ryan, J.L.; Rai, D. (Pacific Northwest Lab., Richland, WA (USA)). *Polyhedron;* **2**: No. 9, 947-952(1983).

The solubility of hydrous UO_2 in sodium hydroxide solutions containing sodium dithionite and/or Zn metal powder as reductants has been measured. The results provide no firm evidence for any amphoteric behavior of U(IV) but do set an upper limit of $K <= 2 \times 10^{-33}$ for the hypothetical reaction: $U^{4+}(aq) + 5H_2O <--> U(OH)_5^- + 5H^+$. The results provide no evidence for such a reaction.

18878 Chemistry of gallium and indium as related to radiopharmaceutical production. Moerlein, S.M.; Welch, M.J. (Washington School of Medicine, St. Louis, MO). *International Journal of Nuclear Medicine and Biology;* **8**: 277-287(1981). Contract AC02-77EV04318.

There is great interest in the medical application of the radioactive isotopes of the group IIIB elements gallium and indium. The design of radiopharmaceuticals labeled with gallium and indium is complicated by the fact that both metals form strong chelates with the plasma protein transferrin. To date, very few compounds of gallium or indium have been described which are thermodynamically stable with respect to exchange to transferrin. However, the rate at which equilibrium is reached is often slow compared to the biological event. As an example of this, the fast glomerular filtration rate of gallium- and indium-DTPA is much faster than the rate of exchange with transferrin. There have been two major efforts in the development of gallium and indium radiopharmaceuticals. The first of these efforts has been to develop a bifunctional chelate such as 1-(p-benzenediazonium)-ethylenediamine-N,N,N′,N′-tetraacetic acid to form a bridge between the metal-EDTA complex and a protein or peptide by means of the azide group. The second approach to the design of gallium and indium radiopharmaceuticals is to develop a labeled species to which transferrin has no access. This has been utilized to great advantage in the labeling of blood components with both indium- and gallium-8-hydroxyquinolate as lipophilic agents to passively diffuse into cells.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

18879 (AD-A—135088/3) Prediction of an apparent flame length in a co-axial jet diffusion flame combustor. Final report 1 Aug 82-31 May 83. Sandhu, S.S. (Dayton Univ., OH (USA). Dept. of Chemical Engineering). 1 Apr 1983. 16p. (UDR-TR—83-38). NTIS, PC A02/MF A01.

This report is comprised of two parts. In Part I a predictive model for an apparent flame length in a co-axial jet diffusion flame combustor is described. According to this model a diffusion flame is considered as thin cylindrical reactive zone composed of chemically active and dead regions. Fuel consumption by surface oxidation is assumed. Mass transport of oxygen to the reactive surface is considered to control the overall combustion process. Overall mass transfer coefficient, evaluated from an empirically developed correlation, is employed to predict total flame length. Comparison of the experimental and predicted data on total flame length shows a reasonable agreement within sixteen percent over the investigated air and fuel flow rate ranges of 1-2kg/s and 5-11kg/hr, respectively. In Part II a scheme to predict an apparent flame length is described for the circumstances when a recirculation region established immediately downstream of a center-body in a co-axial jet combustor is penetrated by a central fuel jet. A turbulent jet flow theory has been coupled with the theory given in Part I of the report.

18880 (AD-A—135383/8) Bifurcation and stability theory with application to problems of combustion and flame propagation. Final report 15 Sep 77-31 May 83. Matkowsky, B.J. (Northwestern Univ., Evanston, IL (USA)). 30 Oct 1983. 9p. NTIS, PC A02/MF A01.

Discussed is a research program in bifurcation and stability theory with applications to combustion and flame propagation, which determined both qualitative and quantitative behavior of solutions of theses problems. Results on the transition from laminar to turbulent combustion were obtained. Various simplified models from the general equations governing combustion, which were more amenable to mathematical analysis were derived. The methods of bifurcation and stability theory were then employed on the resulting models. A list of all the papers published, is appended. In addition a list of scientific personnel participating in the research program is appended.

18881 (AD-A—135685/6) Resonance line broadening of alkali metals in pyrotechnic flames. Doctoral thesis. Dillehay, D.R. (Longhorn Army Ammunition Plant, Marshall, TX (USA)). 15 Apr 1983. 116p. NTIS, PC A06/MF A01.

A mathematical model of a pyrotechnic flame has been developed and validated. The model utilizes a computer program to calculate the relative radiant power of flares containing any of the alkali metals. The computation takes into consideration known system variables such as formulation, candle size, displacement along the plume axis, and atmospheric pressure. These effects were evaluated over a wide range of conditions and the computed spectra follow the established experimental spectra trends. The computer solution is a general solution requiring no ad hoc modifications to the model for any of the metals or conditions tested. The basis for the model of the flame permits calculation of the effects of mixing of the flare plume with the ambient atmosphere and takes heat loss along the plume axis into consideration.

18882 (DOE/ER/10677—7) Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels. Progress report, February 16, 1983-February 15, 1984. Merklin, J.F.; Sorensen, C.M. (Kansas State Univ., Manhattan (USA)). Mar 1984. Contract AC02-80ER10677. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008276.

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We have continued our measurements of soot particulate sizes in flames using both the static extinction/scattering ratio method and Photon Correlation Spectroscopy. The feasibility studies of size distribution measurements using PCS have begun. First, we have used model size distributions to create computer generated light-scattering data. These data have been fit in three different ways to determine the relative feasibilities of size distribution determinations. Second, we have measured PCS spectra from soot in a premixed CH_4/O_2 flame. The data have been analyzed by these methods and have indicated width parameters in the range sigma = 1.30 to 1.35. The same CH_4/O_2 flame was chemically sampled and the sample was analyzed for the major and minor component concentrations. Results are in agreement with the results previously reported in the literature.

18883 (IS-T—984) Upper limit for the methane-oxygen initiation reaction in the presence of iodine-131 behind reflected shock waves. Pardini, S.P. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 114p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84007366.

Thesis.

A one-inch diameter single-pulse shock tube was used to study the rate of methyl iodide formation from 815 to 1151K via the reaction $CH_4 + I \rightarrow CH_3 + HI$ with the observed rate constant $k_{40} = 10^{14.5} \exp(-33.7/RT)$ cm^3/mole sec. Tracer quantities of iodine-131 were used to follow the course of the reaction. At 1097K in a stoichiometric methane-oxygen reaction mixture with small amounts of iodine present, the methane-oxygen initiation reaction, $CH_4 + O_2 \rightarrow CH_3 + HO_2$, was not found to occur, thus put-

ting an upper limit on the rate constant $k_3 = 9.53 \times 10^5$ cm³/mole s. Mass-spectral analysis of the reaction products from the above experiment indicated that formaldehyde was formed; at 1097K oxygen was able to successfully compete with iodine for methyl radicals. The rate constant for the reaction, $CH_3 + O_2 \rightarrow CH_2O + OH$, was found to be $k_4 = 3.96 \times 10^{10}$ cm³/mole s.

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4201 General Engineering

18884 (BDX—613-2993) N/C today - the threshold of change. Miller, C.R. (Bendix Corp., Kansas City, MO (USA)). 1983. Contract AC04-76DP00613. 11p. (CONF-8311101—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008306.

From 12. CAM-I annual meeting and technical conference; Dallas, TX, USA (8 Nov 1983).

This paper presents the state of the art of Numerical Control today, its deficiencies, and future needs. Numerically controlled programming systems have evolved from manual point-to-point programming to CAM systems that utilize various language processors and graphics capabilities. The current needs of these systems and future goals center on enhanced graphic capabilities and true integration of multiple data bases.

18885 (DOE/NBM—4005437) System identification methods and applications. Hsieh, B.J.; Kot, C.A.; Srinivasan, M.G. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84005437.

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Certain systematic approaches which rely on the use of experimental data for the construction of predictive models are given the name of system identification. These methods in principle, are capable of determining the cause-effect relationship in a physical system (in this case a mathematical model and/or its parameters) if the input excitation and the corresponding system response are known. The techniques of system identification are briefly outlined, followed by a more detailed discussion of the state of knowledge in parameter estimation and application of the methods to equipment design and qualification.

18886 (PB—84-137595) Annual report, 1981-1982 (for National Physical Laboratory, New Delhi). (National Physical Lab., New Delhi (India)). 1982. 123p. NTIS, PC E06/MF E06.

This report presents the progress made by NPL during the period April 1981 to March 1982. During this period, research programmes have been pursued in the areas of Standards; Specialized Techniques (Characterisation of Materials); Materials; Radio Science; Solar Energy; Cryogenics and Superconductivity; High Pressure Technology; Applied Physics Projects and other RandD Projects. Primary Standards of time, length, electromotive force and electrical capacitance have been updated. In the Specialized Techniques area, a prototype of an equipment to detect hot journal (axle) boxes of trains has been developed. A photoacoustic spectrophotometer for single beam and double beam modes has been designed and developed for studying the optical and thermal properties of materials. In the area of Materials Development, work on carbon products using pitch coke and high sulphur coke as substitute for petroleum coke was pursued. Carbon fibres have been made with a continuous process after improving techniques of oxidation as well as carbonization.

18887 (UCID—19944-Pt.1) F-14 scale model measurements. Part I. External response. Hudson, H.G; Wythe, D.M. (Lawrence Livermore National Lab., CA (USA)). Jul 1983. Contract W-7405-ENG-48. 277p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84008201.

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This report documents the work accomplished on the scale model F-14 (referred to hereafter as the model) aircraft and only includes measurements taken to date on the external portions of the model. These measurements are intended to simulate the measurements taken on a full scale F-14 aircraft (referred to hereafter as the F-14) at the Air Force Weapons Laboratory (AFWL). The model was tested in eight different configurations of wing position and field incidence. The various model configurations are detailed for which data were taken. All data are presented and include the impulse responses and their Fourier transforms, the estimated model responses to the incident fields of the AFWL Vertically Polarized Dipole (VPD) and the AFWL Horizontally Polarized Dipole (HPD) simulators compared with the F-14 measurements taken at these simulators and a comparison of our transfer functions with CW measurements taken at the same points at the University of Michigans' anechoic measurement facility.

18888 (UILU—79-2016) Statistical analysis of the response of nonlinear systems subjected to earthquakes. Riddell, R.; Newmark, N.M. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). Aug 1979. 310p. NTIS, PC A14/MF A01. Order Number DE84900637.

The dynamic response of single degree of freedom nonlinear systems subjected to earthquake motions is considered with the purpose of deriving factors for constructing inelastic design spectra, and to evaluate the effect of damping combined with inelastic behavior and the influence of the type of material nonlinearity on inelastic response. Inelastic response spectra for elastoplastic systems with 2, 5, and 10 percent damping, and for bilinear and stiffness degrading systems with 5% damping, are computed for a number of frequencies ranging from about 0.03 cps to 35 cps, for ductility values from 1 to 10, and for ten strong-motion earthquake records. A statistical procedure is developed to analyze the data; from this analysis, factors for deriving the characteristic trapezoidal design spectrum are obtained. Such factors reflect, in an explicit manner, the effect of the various parameters considered.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 17995, 17996, 17997, 17998, 17999, 18000, 18001, 18018, 18019, 18071, 18134, 18146, 18233, 18671, 18886

18889 (AD-A—134873/9) Evaluation of superconducting augmentation on a rail gun system. Technical report. Homan, C.G.; Scholz, W. (Army Armament Research and Development Command, Watervliet, NY (USA). Large Caliber Weapon Systems Lab.). Jun 1983. 31p. (ARLCB-TR—83016). NTIS, PC A03/MF A01.

The simple rail gun and rail guns with normally conducting and superconducting augmentation are discussed using an energy approach. Ideal launch efficiencies neglecting Joule losses and assuming constant rail current during the launch are shown to be 50 percent for normally conducting systems, and up to 100 percent for systems with superconducting augmentation. Energy requirements of an actual system are compared with expected values for a system with superconducting augmentation. The situation of variable rail currents has also been discussed.

18890 (AD-A—135089/1) Acoustic microscopy at cryogenic temperatures. Annual summary report 1 Jul 82-30 Jun 83. Quate, C.F. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). Sep 1983. 14p. (GL—3628). NTIS, PC A02/MF A01.

The acoustic microscope operating in superfluid helium now has a resolution of 500 Angstroms. The images from this instrument are superior to those in an optical microscope and exhibit some features that rival those of the SEM. Immediate progress should permit us to move up in frequency by a factor of two and improve the resolution accordingly. Another mode of imaging is described which exploits thermal phonons in solids and holds promise of providing information on the interior details of solid structures.

18891 (AD-A—135102/2) Film synthesis and new superconductors. Final technical report 1 Oct 77-15 May 83. Geballe, T.H. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). May 1983. 42p. (GL—3566). NTIS, PC A03/MF A01.

This research has been concerned with films that are metastable compounds or multilayered composites which are quenched

from the vapor phase. They have been stabilized by a number of methods which aid in the quench or by growing upon especially prepared surfaces upon which epitaxial growth can take place. The occurrence of superconductivity in the metastable films has been investigated. Newly developed methods of heat capacity and tunneling techniques have been used to study the superconducting interactions and to provide the increased understanding of the mechanisms of superconductivity necessary to reach higher transition temperatures.

18892 **(AD-A—135339/0) Design, construction, and test of a 0.61-meter-diameter, epoxy impregnated superconductive magnet. Research and development report.** Waltman, D.J.; Superczynski, M.J.; McDonald, F.E. (Naval Ship Research and Development Center, Annapolis, MD (USA)). Oct 1983. 40p. (DTNSRDC/PAS—81/18). NTIS, PC A03/MF A01.

To determine the performance and quench behavior of a large, fully-potted, NbTi superconductive magnet, a 0.61-m test coil has been constructed which contains heaters, thermocouples, and strain gauges installed at various winding locations. The magnet has an inductance of 49 henries, 7502 turns of copper stabilized NbTi wire, and a magnet load-line critical point of 190 amperes at 6.5 tesla. The methods and techniques used to construct the fiber glass reinforced, epoxy impregnated magnet are described. The results of the electrical and thermal measurements of the test coil behavior for quenches initiated at various winding locations and at operating currents of up to 150 amperes are presented. The laboratory measurements results are compared to the results obtained from the QUENCH computer program simulation of this magnet to assess the program's ability to describe the actual quench behavior of the magnet.

18893 **(AD-A—135866/2) Tunneling through amorphous silicon barriers. Final report, July 1982-August 1983.** Kroger, H.; Smith, L.N.; Jillie, D.W.; Thaxter, J.B. (Sperry Research Center, Sudbury, MA (USA)). Oct 1983. 31p. (SRC-CR—83-37). NTIS, PC A03/MF A01.

Substantial evidence has been accumulated during the course of this program which indicates that the localized states which are present in nonhydrogenated sputtered amorphous silicon barriers contribute to the larger current density observed at biases below the superconducting energy gap of the electrodes. The basic observations and the method of measuring the density of localized states at the Fermi level of the barrier materials are presented in the Appendix which is a reprint of a paper presented at the 1982 Superconductivity Conference. More recent observations and theoretical speculations are included in this report.

18894 **(AD-B—064647/1) Qualification operational test and evaluation (qotande). test plan for chemical warfare defense ensemble gloves.** Michels, J.B.; Rush, W.J. Jr. (Air Force Test and Evaluation Squadron (1815th), Wright-Patterson AFB, OH (USA)). 1982. 34p. NTIS, PC A03/MF A01.

The Air Force Communications Command (AFCC) Chemical Warfare Defense Task Evaluation Program was initiated on 8 July 1980 to determine the effects of AFCC mission performance while performing duties in chemical/biological full cover protective clothing. During this program, problems were encountered while using the butyl rubber Chemical Warfare (CW) gloves. Specifically, loss of manual dexterity and factility affected the performance of many Engineering and Installation (EI) and communications Operations and Maintenance (OandM) tasks. AFCC provides air traffic control and communications services for all USAF field and component commanders, including those in combat areas. These include engineering, installation, operation and maintenance of base communications functions, long range communications, tactical communications, and air traffic services. These services must be provided during all periods of conventional and nonconventional warfare, to include the use of toxic chemical agents by foreign enemies. The Air Force need is for a protective glove that will afford both a high level of protection and allow as close to normal operations as possible to continue during the periods of toxic chemical contamination.

18895 **(DOE/ET/11289—T7) Investigation of modified zirconia thermal barrier coatings for gas turbine applications. Summary report, September 24, 1979-May 24, 1980.** Siemers, P.A.; McKee, D.W. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). 24 May 1980. Contract AC05-77ET11289. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009360.

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Stabilized zirconia ceramics appear to have considerable potential as thermal barriers or corrosion resistant coatings for application to gas turbine components. Salt corrosion tests have indicated however that under some conditions vanadium impurities in the fuel may cause accelerated failure of these coatings as a result of destabilization of the zirconia phase. The corrosion resistance, thermal stability and structure of the coatings depend to a large extent on the chemical composition of the ceramic phase. The results of a study of the behavior of plasma-sprayed Y_2O_3-ZrO_2 coatings towards combustion gases and the typical salt deposits likely to be encountered in gas turbines which burn fuels containing sodium, sulfur, lead and vanadium impurities are described.

18896 **(KFK—3576) Technical and physical design of a 4.2 K cryostat and its cooling circuit for a superconducting 500 MHz resonator.** Graf, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Aug 1983. 45p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750859.

During the year 1982 an experiment was undertaken where a superconducting accelerating cavity was operated in the e^+-e^--storage ring PETRA at DESY in Hamburg. This report describes the construction of the cryostat used including the necessary auxiliary equipment and gives a summary of the operating experience gained.

18897 **(LBL—16535) Pulsed magnetic field testing of multifilamentary Nb_3Sn superconducting wire.** Glazer, J.; Dietderich, D.R.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 12p. (CONF-830841—32). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008250.

From Cryogenic engineering conference and international cryogenic materials conference; Colorado Springs, CO, USA (15 Aug 1983).

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This work confirms that, at a minimum, pulsed field magnets may be used to obtain preliminary qualitative results about superconducting samples. Although the quantitative critical current data is not as reliable as that obtained under steady fields, at high fields there is good agreement between the data. Because of the many factors that may play a role, explanation of the degraded critical currents found under pulsed fields at lower applied fields is difficult. Given the current state of theory, much further investigation would be needed to clarify the precise causes of this effect and its generality to other superconductors. Nonetheless, it is apparent that pulsed field magnets may be effectively used to direct the design process, thus allowing steady field testing facilities to be reserved for testing the more promising materials.

18898 **(NP—4770160) Theoretical and experimental investigations of fluid flow in curved channels of turbomachines.** Zahn, G. (Bochum Univ. (Germany, F.R.). Abt. fuer Maschinenbau). 10 Mar 1982. 222p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84770160.

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For the design of radial turbo machines and hydrodynamic transformers a detailed knowledge of the flow processes in the different flow channels is necessary. The dissipation losses in these channels have to be considered for the evaluation of the total system efficiency, and the characteristic of the input flow profile determines the shape of the next component. A mathematical model is presented for the calculation of the flow fields in these channels. In order to account for the secondary flows induced by the curved channels, the model is extended to the three-dimensional case, and the dissipation and turbulence effects are considered, which are essential for the evaluation of the losses. Turbulence is taken into ac-

count by the mixing path hypothesis of Prantl and other empirical relations, and the loss coefficients of the reversing channels are obtained from experimental data and numerical models.

18899 **(NUREG/CR—0200-Vol.3) SCALE: a modular code system for performing standardized computer analyses for licensing evaluation. Volume 3. Miscellaneous.** (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 140p. (ORNL/NUREG/CSD—2/V3/R1). NTIS, PC A07/MF A01 - GPO. Order Number DE83013747.

This manual provides documentation for a new, multi-faceted computational system called SCALE (Standardized Computer Analyses for Licensing Evaluation) that has been developed to provide a standard analysis tool for use by the NRC staff and licensees in evaluating nuclear fuel facility and package designs. The SCALE system consists of several automated analytical sequences (control modules) which perform criticality, shielding, and/or heat-transfer calculations with a minimum of user-required input. The computer codes (functional modules) used within each analytical sequence can also be run in a stand-alone fashion or coupled together in a sequence determined by the user. This volume describes the ORIGEN-S data library and the Standard Composition library.

18900 **(PB—84-115849) National Bureau of Standards journal of research. Volume 88, Number 4, July-August 1983. Bi-monthly report.** (National Bureau of Standards, Washington, DC (USA)). Aug 1983. 65p. NTIS, PC A04/MF A01.

Contents: Apparatus for density and dielectric constant measurements to 35 MPa on fluids of cryogenic interest; An intercomparison of pressure standards between the Istituto di Metrologia 'G. Colonnetti' and the National Bureau of Standards; Analysis of liquid flow-induced motion of a discrete solid in a partially filled pipe.

18901 **(PB—84-140060) Proposed method for model temperature conditioning in cryogenic wind tunnels.** Bald, W.B. (Oxford Univ. (UK). Dept. of Engineering Science). Jun 1983. 22p. (OUEL—1480/83). NTIS, PC E03/MF E03.

Previous reports have shown the need and advantages to be gained by pre-cooling models to liquid nitrogen temperature prior to insertion in a cryogenic wind tunnel. This report summarizes the experimental and theoretical work which has been carried out into possible methods of pre-cooling models to a uniform temperature in a bath of cryogenic liquid. A new technique is proposed which would enable models to be pre-cooled to any desired uniform temperature prior to tunnel insertion.

18902 **(RFP—3569) Remote engineering progress report, January-December 1982.** Brown, C.M. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 27 Feb 1984. Contract AC04-76DP03533. 37p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009309.

Discussed briefly are the objectives, prior work (if any), present achievements, and future work in the following areas: an automated storage, transfer, and retrieval system for laboratory specimens; automation of molten salt button breakout operations; emission spectrometer automation, direct oxide reduction process support; hydride operations support; part serialization processes; contact handled waste container welding; automated sample cutting; filter probe positioner; Unimate robot replacement to handle uranium ingots in a hot pressing operation; development and testing of a device to automate compacting on site return nuclear weapons parts for pyrochemical operations; remote transfer system for gloveboxes (made from a modified radio-controlled toy tank); plutonium oxide/skull burn and reburn process; advanced size reduction facility; automation of the plutonium oxide pelletizing process for chemical analytical laboratory operations; automated assembly demonstration for a Mechanical Safe and Arm Detonator (MSAD); and a stacker-retriever remote vacuum cleaning system. (LEW)

18903 **(RISO-M—2270) Shielding factors for gamma radiation from activity deposited on structures and ground surfaces.** Hedemann Jensen, P. (Risoe National Lab., Roskilde (Denmark)). Nov 1982. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700107.

This report describes a computer model that calculates shielding factors for indoor residence in multistorey and single-family houses for gamma radiation from activity despoited on roofs, outer walls, and ground surfaces. The dimensions of the buildings including window areas and the nearby surroundings has to be specified in the calculations. Shielding factors can be calculated for different photon energies and for a uniform surface activity distribution as well as for separate activity on roof, outer wall, and ground surface achieved from decontamination or different deposition velocities. For a given area with a known distribution of different houses a weighted shielding factor can be calculated as well as a time-averaged one based on a given residence time distribution for work/school, home, outdoors, and transportation. Calculated shielding factors are shown for typical Danish houses. To give an impression of the sensitivity of the shielding factor on the parameters used in the model, variations were made in some of the most important parameters: wall thickness, road and ground width, percentage of outer wall covered by windows, photon energy, and decontamination percentage for outer walls, ground and roofs. The uncertainity of the calculations is discussed.

18904 **(SAND—84-0515C) Sandia National Labs/US Department of Transportation fire research program.** Trujillo, A.A.; Diggs, J.M.; Nelsen, J.M.; Orth, C.L. (Sandia National Labs., Albuquerque, NM (USA); Department of Transportation, Washington, DC (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-840307—13). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008333.

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

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A program has been established to develop technology that will support the design and licensing of Nuclear Material Transportation Systems. One component of the technology program is a task that seeks to gain a better understanding of the parameters that influence the thermal response of shipping casks to fire environments. Tests involving exposure to torch and engulfing pool fire environments have been conducted. Issues related to the response of a shipping cask to torch fires as well as the repeatability of and thermal flux generated by open pool fires are addressed. 6 references, 5 figures.

18905 **Remote selective release of gases inside a container.** Reynolds, R.K. (Raymond Kaiser Engineers, P.O. Box 23210, BB-4 Oakland, CA 94623). *Transactions of the American Nuclear Society;* **45**: 799(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18906 **Remote radioactive waste handling using high-integrity containers.** Mallory, C.W. (Hittman Nuclear and Development Corporation, 9190 Red Branch Road, Columbia, MD 21045). *Transactions of the American Nuclear Society;* **45**: 793-794(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18907 **(RISLEY-Trans—4778) Bayonet cover.** Vorob'ev, Yu.V.; Kudashev, V.G.; Peganova, G.G.; Shmelev, V.D. (UKAEA Risley Nuclear Power Development Establishment). 6 Sep 1983. Translation source information not available . 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900798.

The invention relates to a device for the frequent and rapid opening and closing of vessels, for example, those containing nuclear fuel. The purpose of the invention is to preclude deformation of the lining when the cover is introduced into the vessel. The purpose is achieved by having in the proposed cover pre-sprung pins and catches, and in the bottom a ring with projections. (LEW)

18908 **(RISLEY-Trans—4797) Flask for transporting radioactive fuel elements.** Vox, A.J. (UKAEA Risley Nuclear Power Development Establishment; Vox Lumatic G.m.b.H., Ostfildern (Germany, F.R.); Amtrust A.G., Luzern (Switzerland)). 23 Aug 1983. C; German Patent 28,28,138. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900802.

The present invention concerns a flask for transporting radioactive fuel elements with a loading compartment, preferably dry, for receiving fuel elements and a flask housing enclosing it.

18909 **(RISLEY-Trans—4800) Transport and storage flask for spent fuel elements from nuclear reactors.** Baatz, H.; Rittscher, D. (Gesellschaft fuer Nuklearservice, Essen (Germany, F.R.)). 23 Aug 1983. C; German Patent 29,43,085. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900809.

The invention relates generically to a transport and storage flask of cast iron, steel or similar material, for spent fuel elements from nuclear reactors, with a central loading compartment which can be closed by a cover, in which is arranged a basket with crossed partition walls forming cells. These cells are designed to accommodate one nuclear reactor fuel element each. The loading compartment of this type of transport or storage flask has a rectangular or square cross-section with rounded corners or a circular one. Storage flask means both interim and final storage flask.

4203 Lasers

REFER ALSO TO CITATION(S) 18811, 18945

18910 **(AD-A—134866/3) Modeling study of a cw hf resonance transfer laser medium. Technical report.** Kwok, M.A.; Wilkins, R.L. (Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.). 30 Sep 1983. 81p. (TR—0083(3603)-3). NTIS, PC A05/MF A01.

A nonreactive kinetics model of the flowing gaseous medium of a cw HF optical resonance transfer laser (ORTL) has been developed and used to examine the prospects of this type of laser for efficient performance. Model development has required the generation of HF(v1, J1) + HF(v2, J2) V-V, R-R, T, and V-R cross section by classical trajectory calculations and by surprisal methods. These cross section packages have been validated using non-ORTL HF kinetics experiments, and the entire ORTL medium model has been validated by modeling the reported experimental results of past ORTL experiments without any adjustment of the kinetics packages. The subsequent study observing the effect on small signal gain by varying controllable parameters, such as pumping laser radiative flux and flux distribution, flow velocity, flow density, and HF mole fractions, has suggested a regime for most efficient ORTL operation, in which overall efficiency could reach 0.50. For this regime., pumping laser fluxes should exceed 5000 W/per sq cm with a spectral pattern in which most of the power is in P1(5), p1(6), p2(5), and p2(6). The medium should be operated at slightly elevated temperatures to enhance kinetic-pumping rates with characteristic velocities allowing any ORTL fluid element to remain in the pump beam no longer than 200 microsec.

18911 **(AD-A—135155/0) Program on electrically tunable semiconductor laser source for optical fiber sensors. Final report.** Tang, C.L.; Olsson, A. (Cornell Univ., Ithaca, NY (USA). School of Electrical Engineering). 30 Jul 1982. 14p. NTIS, PC A02/MF A01.

The objective of the program was to develop an electrically tunable semiconductor laser. This laser was to have a smooth tuning curve and is to be electrically tunable over a large spectral range and extremely rapidly tunable. A possible application of such a laser was as the basic tunable laser source of optical fiber sensors.

18912 **(AD-A—135793/8) Radiative collisional laser feasibility demonstration. Final report, 16 November 1981-15 February 1983.** Tang, K.Y.; Tilton, R.A.; Wells, W.E. Jr; Downes, L.W.; Marcum, S.D. (Western Research Corp., San Diego, CA (USA)). 7 Dec 1983. 58p. (WRC—713-R). NTIS, PC A04/MF A01.

Collisional radiative process between metastable state He and ground state N_2 was investigated through two separate experiments: gain/absorption in electron-beam excited He/N_2 gas mixtures, and change of He metastable density in the presence of external photon flux. No net gain was observed in He/N_2 system as it was presumably overwhelmed by the background absorption. However, the preliminary results of our He metastable density measurement gives strong evidence for existence of collisional radiative process.

18913 **(AD-A—135873/8) Intense excitation source for high power (blue-green) laser. Final report, 25 September 1980-10 September 1983.** Han, K.S. (Hampton Inst., VA (USA). Dept. of Physics and Engineering Studies). 22 Nov 1983. 93p. NTIS, PC A05/MF A01.

A high power blue-green dye laser has been pumped with an array of hypocyloidal-pinch (HCP) plasmas. The HCP pump source was energized by up to 4.2kJ energy stored in the capacitor bank. High pressure optical conversion. The maximum argon pressure used was 100 Torr with the optimum at 20 Torr. The rise time (approx. 1 micron) of pumping light is kept short by using a small (6 micron F) capacitance. The laser output power and energy dependence of the input electrical energy, the type of gas, the filling pressure and the laser cavity parameters were studied with respect to the characteristics of the pumping light. The plasma temperature 7,250 K was obtained when the HCP was operated for the optimum laser output. The spectral efficiency of the absorbed radiation at this temperature was 22% or 83% of the maximum efficiency of the optimum blackbody source. The author concluded that the HCP source has uv-rich spectrum, which can be varied to match the most efficient spectrum for laser pumping, and very high input capability. Thus it is suitable for repetitive and high average power laser systems.

18914 **(AD-A—135894/4) Energetics and collision dynamics of electronic transition lasers. Final report, 1 August 1981-31 July 1983.** Michels, H.H.; Hobbs, R.H. (United Technologies Research Center, East Hartford, CT (USA)). Oct 1983. 43p. (UTRC/R—82-925832). NTIS, PC A03/MF A01.

Quantum mechanical studies, including both ab initio configuration-interaction expansions and density functional calculations, have been carried out to examine the electronic structure, radiative lifetimes and collisional branching ratios for molecules of importance in studies of electronic transition lasers. These studies have included an analysis of the energetics of Mg/Mg0 excitation transfer reactions, the spectroscopy of the low-lying electronic states of the I2 and I3 molecules and the mechanisms of the I2/02 1 Delta g dissociation kinetics. In addition, a study of the electronic structure of the NaMg system was carried out to evaluate its potential as a excimer laser.

18915 **(AD-A—135984/3) Nonlinear orbits in free-electron lasers with a linear magnetic wiggler and a strong axial magnetic guide field.** Hafizi, B.; Aamodt, R.E. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Oct 1983. 42p. (SAI—83-1124/PRI-66). NTIS, PC A03/MF A01.

Single particle trajectories in a free electron laser device consisting of a linear periodic wiggler superimposed on a strong uniform axial guide field are examined by a formalism suitable for perturbation analysis and adaptable to wigglers of arbitrary geometry. For motion locked on to a single resonance (between the gyromotion and the periodicity induced by the wiggler in the axial velocity) and for sufficiently weak wiggler fields, bounded oscillations of the gyroradius and axial velocity are possible for a limited region of parameter and phase space. Optimal parameters for which the largest fraction of particles entering the drift chamber experience limited excursions in gyroradius and in axial velocity are determined. The mean drift of the guiding center off axis is used to determine the allowable length of the wiggler and of the drift tube for beam propagation. With increasing wiggler field bounded motion is eliminated, leading to transition between resonances, chaotic motion and significant spread in axial velocities of electrons. Comparison with experimental results is presented.

18916 **(AD-A—136088/2) Investigation of cold cathode and rf excitation for long life CO_2 waveguide lasers. Final report, May 1982-May 1983.** Hochuli, U. (Maryland Univ., College Park (USA). Dept. of Electrical Engineering). Mar 1983. 28p. NTIS, PC A03/MF A01.

Document describes a Ag-Li compound cathode for the longitudinally d.c. excited, low power, CO_2 waveguide laser. Discharge tube results with this cathode produced an acceptable gas composition over a period of 1000 hours. The sputtering rate was quite low and, most importantly, the sputtering products did adhere quite well in the form of a thin film on the closest, cooler surfaces. A laser, using two of these cathodes, still produced 72% of its initial power output after 9200 hours of continuous service. Failure analysis indicated internal mirror damage on one of the mirrors, most likely due to improper selection of the dielectric top layer. Considerably more sputtering took place in the laser than in the discharge tube due to a laser cathode temperature that was too low. In parallel with these efforts we have started to investigate the life potential of the transversely r.f. excited waveguide laser. Preliminary results are quite encouraging. These tests were carried out over periods close to 3000 hours and indicate that proper selection of electrode materials is quite important. A wave guide laser with one of the waveguide sides made from a platinum alloy still yields 74% of its initial 2.85W after 5200 hours of continuous operations.

18917 **(BDX—613-2911) Nd: YAG laser improvements and modifications.** Holt, R.D.; Mallory, M.B. (Bendix Corp., Kansas City, MO (USA)). Mar 1984. Contract AC04-76DP00613. 31p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009024.

A 400 W Nd:YAG laser system, was rebuilt and modified by Bendix Kansas City. Many improvements and additions were made, most notably: output power stability, flash lamp life, a laser flash inhibitor, a rotary axis, wire feed, power-driven camera focus, and a power-driven laser lens positioning system with digital display of position. This system now fully and reliably functions on the production line. These new additions significantly improve the versatility and capability of this laser system.

18918 **(PLF—33) Investigations of molecular halogen lasers.** Diegelmann, M. (Max-Planck-Gesellschaft zur Foerderung der Wissenschaften e.V., Garching (Germany, F.R.). Projektgruppe fuer Laserforschung). Aug 1980. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750498.

This work reports on experimental and theoretical investigations of D' -> A' transitions from an ionically bound upper level to a covalent lower state in diatomic halogen molecules. In homonuclear molecules laser action had been achieved by other authors. Experimentally, mixtures of various halogen donor compounds and a rare gas buffer were excited with a short pulse relativistic e-beam. Resulting fluorescence and laser emissions were measured spectrally and temporally resolved. Laser experiments were carried out in a discharge pumped TEA laser set-up, too. Fluorescence spectra were recorded for the D' ($^3\pi$sub(2g)) -> A' ($^3\pi$sub(2u)) transitions in F_2 and Cl_2 as well as for the analogous transitions in all heteronuclear halogen molecules. The fluorine and chlorine spectra had been measured before this work, however with lower resolution. With the exception of ICl, none of the interhalogen spectra were known until then.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 18503, 18898

18919 **(ANL—83-108) ANL/HTP: a computer code for the simulation of heat pipe operation.** McLennan, G.A. (Argonne National Lab., IL (USA)). Nov 1983. Contract W-31-109-ENG-38. 45p. NTIS, PC A03/MF; 1; GPO Dep. Order Number DE84009132.

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ANL/HTP is a computer code for the simulation of heat pipe operation, to predict heat pipe performance and temperature distributions during steady state operation. Source and sink temperatures and heat transfer coefficients can be set as input boundary conditions, and varied for parametric studies. Five code options are included to calculate performance for fixed operating conditions, or to vary any one of the four boundary conditions to determine the heat pipe limited performance. The performance limits included are viscous, sonic, entrainment capillary, and boiling, using the best available theories to model these effects. The code has built-in models for a number of wick configurations - open grooves, screen-covered grooves, screen-wrap, and arteries, with provision for expansion. The current version of the code includes the thermophysical properties of sodium as the working fluid in an expandable subroutine. The code-calculated performance agrees quite well with measured experiment data.

18920 **(CONF-841201—5) Fluid forces on a rigid cylinder in turbulent crossflow.** Mulcahy, T.M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84006364.

From ASME winter annual meeting; New Orleans, LA, USA (9 Dec 1984).

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Fluctuating lift and drag, as well as steady drag force coefficients are presented which were obtained in water flows with Reynolds numbers in the range 3×10^4 to 2×10^5. Turbulence intensities were varied from 1.5 to 15% while integral scale lengths ranged from 0.5 to 2 tube diameters. The turbulence generated is described and the method of force measurement is outlined. Empirical bounds on the force spectra are given, and available information on spanwise correlation lengths are identified so that the data can be used to make RMS vibration response predictions where fluid-structure interaction does not occur.

18921 (DOE/PC/40789—T9, pp 9-32) **Heat transfer through granular beds at high temperature.** Zumbrunnen, D.A.; Viskanta, R.; Incropera, F.P. (Purdue Univ., West Lafayette, IN). 1984. NTIS, PC A03/MF A01.

In Thermal and radiative properties of coal-ash deposits. Technical progress report No. 9, December 1, 1983-February 29, 1984.

A comprehensive approach has been followed to determine parameters needed to correlate thermal conductances of packed beds comprised of granular opaque particles in a nonparticipating fluid. An apparatus has been designed and used to measure thermal conductances for several packed beds over a wide temperature range. Parameters required by an existing theoretical model were inferred from the measurements, and model calculations were performed to determine those parameters which affect thermal conductance. The thermal conductance of packed beds has been found to increase with the temperature difference across the bed thickness. 5 references, 8 figures.

18922 **(FEI—1327) Calculating the hydraulic characteristics of a plane axially symmetrical feeding collector.** Yur'ev, Yu.S.; Vladimirov, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700116.

Two-dimensional equations of liquid flow in a reactor plane cylindrical axially symmetrical feeding collector without and in the presence of friction and volume resistance are analyzed. The analytical solutions for some particular cases of spiral flow (hyperbolic spiral, logarithmic spiral, Archimedean spiral) are obtained. It is shown that the type of flow is determined by the effective Reynolds number and effective coefficient of volume hydraulic resistance. Non-uniformity in coolant feeding when the hydraulic resistance is increasing descreases at first and then changing the sign increases in absolute value.

18923 **(FEI—1361) Calculation of efficient thermal conduction in a reactor fuel rod cluster.** Buksha, Yu.K.; Bagdasarov, Yu.E.; Kuznetsov, I.A.; Nikolaeva, G.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700117.

On the base of solving the equation of heat transfer a formula for determination of the efficient thermal conduction heat transfer used in calculations of temperature profile in fuel rod clusters during accidents connected with failures in heat removal from their surfaces is obtained. An algorithm for computerized solution of the problem is described.

18924 **(FEI—1374) Calculation technique for random deviations of burnout margin.** Yur'ev, Yu.S.; Kanukhina, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700118.

The burnout margin in fuel element bundles with constant heat release is analyzed as a complex random quantity, whose dispersion consists of dispersions of may independent quantities: structural, technological, physical, thermal, performances of fuel elements, fuel element clusters and a reactor as a whole. Technique for determination of the magnitude and sign of weight factors, that is the factors of the parameter deviation effect on the burnout margin range, has been developed. The weight factors are determined from linearization of analytical dependences. The technique is elaborated to have obtained calculation formulae and tables.

18925 **(FEI—1377) Liquid distribution between a flow core and near-wall film in a tube with a single turbulizer.** Boltenko, Eh.A.; Peskov, O.L.; Pomet'ko, R.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700119.

Results are presented of experimental investigation into fluid distribution between a flow core and film in a tube with a single turbulizer at 1.06 MPa freon-12 pressure (equivalent to 6.86 MPa W. C. pressure), mass flow rate rhoW=1000, 2000 kg/m²s, the tube diameter d=8 mm, and turbulizer height h=1 mm. It is shown, that the effect of a single heat removal intensifier on the processes of droplet precipitation from a flow core on the near-wall fluid film is different for the investigated mass rates. Burnout in the presence of a turbulizer is practically specified by complete dryout of near-wall fluid film.

18926 **(FEI—1379) Analysis of vapour (gaseous) bubble movement after their leaving a surface in the forced flow of a liquid.** Smogalev, I.P.; Gubanova, L.A.; Medvedeva, L.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700120.

Analysis of motion of vapour (gas) bubbles after their separation from the surface are presented. The equations of bubble motion with provision for basic forces affecting them near the wall is solved. It is shown that a part of the bubbles moves along the surface and another part escapes to the flow core. Formulae for the calculation of the bubble part moving along the surface of the total bubble quantity formed on it are given.

18927 **(K/PS—5026) Determination of fan flow and water rate adjustment for off-design cooling tower tests.** Vance, J.M. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Feb 1984. Contract W-7405-ENG-26. 12p. (CONF-840238—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007960.

From Cooling Tower Institute annual technical meeting; Houston, TX, USA (6 Feb 1984).

The determination of the performance of a mechanical draft cooling tower requires that the air mass flow through the tower be known. Since this flow is not measured, it has been customary to use the manufacturer's design air flow and adjust it by the one-third power of the ratio of the design to test fan horsepower. The most nearly correct approximation of air flow through a tower can be obtained by incrementally moving through the tower from air inlet to outlet while calculating mass flows, energy balances, and pressure drops for each increment and then utilizing fan curves to determine volumetric and mass flows. This procedure would account for changes in air humidity and density through the tower, evaporation of water, effect of water rate on air pressure drop, and changes in fan characteristics. These type calculations may be within the capabilities of all in the near future, but for the interim, it is recommended that a more elementary approach be used which can be handled with a good calculator and without any proprietary data. This approach depends on certain assumptions which are acceptable if the tower test is conducted within CTI code requirements. The fan must be considered a constant suction volume blower for a given blade pitch. The total pressure at the fan, a function of volumetric flow and wet air density, must be assumed to be unaffected by other considerations, and the fan horsepower must be assumed to change only as volumetric flow and wet air density changes. Given these assumptions, along with design information normally provided with a tower, the determination of air flow through a tower in a test can be made from CTI test data. The air flow, and consequently the water rate adjustment and corrected water to air ratio, are derived and found to be direct functions of horsepower and density and an inverse function of wet air humidities.

18928 **(KFK—3593) Heat transfer for turbulent flow of helium or hydrogen in a tube at high temperatures: evaluation with the method of Petukhov.** Dalle Donne, M.; Tartaglia, G.P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1983. 82p. (EUR—7988e). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750886.

Experimental heat transfer data of various authors for the turbulent flow of helium or hydrogen in circular tubes at very high wall temperatures (up to 2800°C) have been reevaluated with the method of Petukhov. Of these data, the data for the tests with not constant heat flux distribution along the tube have been corrected with the superposition method. The Petukhov correlation method does not account completely for the increase of the heat transfer coefficient in the entrance region of the tube. However, for the downstream region the correlation is successful. The 1624 reevaluated experimental points are correlated with a standard deviation of 7.0% for $2 <= l/d <= 316$.

18929 **(LBL—17244) Two phase turbulent flow measurements in a ninety degree bend using laser doppler anemometry.** Kliafas, Y. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 255p. NTIS, PC A12/MF A01; GPO Dep. Order Number DE84007974.

Thesis.

This report is divided into two main parts. The first part provides detailed measurements of the mean air velocities and the corresponding turbulent stresses in a 90° bend of strong curvature ratio ($R/sub\ r/ = R/D = 1.76$) for high Reynolds numbers (2.2×10^5 and 3.74×10^5). To improve the understanding of turbulent high speed air flows in a 90° bend, we have provided as much information as possible about the mean and turbulent quantities of the flow; these have been presented in a form suitable for the evaluation of numerical techniques. The second part provides detailed measurements of the mean velocities and the corresponding turbulent stresses for the solid phase (50 and 100 μm glass beads), while maintaining the same flow conditions. The detailed observations should help the understanding of the physical phenomena occurring in suspension flows and assist with the development of mathematical models in turbulent two-phase flows.

4205 Materials Testing

REFER ALSO TO CITATION(S) 18475, 18577

4206 Safety Engineering

REFER ALSO TO CITATION(S) 19221

18930 (BMFT-FB-HA—83-023) Ignition of dust-air mixtures by mechanical sparks. Braubach, H.O. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1983. 48p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750500.

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In approx. 40% of the dust explosions that occur, the ignition source is presumed to be mechanically generated sparks. Since no reliable information is available, either on the formation of such sparks or on their energy or the possible ignition mechanism, it is difficult in practice to evaluate measures taken to avoid mechanical ignition sources. A test apparatus has been constructed in which the formation of mechanically generated sparks and their ability to cause dust explosions can be investigated under conditions approximating to those encountered in practice. Details are given on the problem involved, the construction and mode of action of the apparatus and the initial tests carried out.

18931 (LBL—17377) Strong seismic ground motion for design purposes at the Lawrence Berkeley Laboratory. Bolt, B.A. (Lawrence Berkeley Lab., CA (USA)). Jul 1979. Contract AC03-76SF00098. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008279.

A design earthquake ground motion was determined for the Lawrence Berkeley Laboratory site. The required ground motions correspond to what has been called a "maximum credible earthquake". The synthesized accelogram was used under the name BOLTQUAKE in tests of shaking on the proposed HVEM foundation block. 6 references, 5 figures. (ACR)

4208 Electronic Circuits And Devices

18932 (AD-A—135896/9) Theoretical and experimental investigation of heterojunction interfaces. Final report, 1 September 1976-30 June 1983. Kraut, E.A.; Grant, R.W.; Waldrop, J.R.; Kowalczyk, S.P. (Rockwell International Corp., Anaheim, CA (USA). Electronics Research Div.). Nov 1983. 72p. NTIS, PC A04/MF A01.

A technique based on the use of x-ray photoelectron spectroscopy was developed to measure heterojunction band discontinuities with an uncertainty of + or - 0.04 eV and changes in band discontinuities for a specific heterojunction interface with an uncertainty of + or - 0.01 eV. This technique was used to investigate Ge-GaAs, GaAs-AlAs, ZnSe-GaAs, and ZnSe-Ge heterojunctions. It was discovered that microscopic dipoles present at abrupt heterojunction interfaces can substantially affect observed band discontinuities. Variations in heterojunction band discontinuities as functions of crystallographic orientation, growth sequence, and growth conditions were observed. It was established that heterojunction band discontinuities depend on microscopic properties of the interface and cannot be predicted from individual semiconductor properties alone. Based on electrostatic considerations, it was shown that polar heterojunction interfaces cannot be atomically abrupt but must require at least two interfacial transition planes to be consistent with experimental observations.

18933 (UCRL—53515) Heat-transfer microstructures for integrated circuits. Tuckerman, D.B. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 156p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84009137.

Thesis.

Convective heat-transfer theory indicates that well over 1000 W/cm^2 can be compactly removed from ICs at normal operating temperatures, provided microscopic (e.g., 50-μm wide) extended-surface structures are used. The difficulty of constructing high-conductance, low-stress thermal interfaces between ICs and heat sinks suggests the use of an integral heat sink. Accordingly, IC microfabrication techniques were employed to design, fabricate, and test novel, ultracompact water-cooled, laminar-flow, optimized plate-fin and pin-fin heat sinks directly within standard-thickness silicon substrates. Worst-case thermal resistances as low as 0.083°C/W were measured from 1-cm^2 thin-film resistors. The use of integral liquid-cooled heat sinks in multichip systems presents potential yield, reliability, cost and packaging problems. Attachment of unmodified ICs to micro-heat sinks seems a more attractive approach. A novel die-attachment technique has been developed which avoids the problems of conventional attachments. In this technique, a liquid partially fills an array of micron-wide reentrant capillaries in the heat sink substrate, so that surface tension holds the polished back of an IC in intimate thermal contact with the heat sink. The bond is void-free, virtually stress-free, long-lived, and allows repeated detachment and replacement of ICs without damaging the heat sink substrate. The reentrant grooves were fabricated by a noval process using electroless plating of nickel onto vertical silicon microgrooves. For a 1-cm^2 area, typical interfacial thermal resistances of 0.022°C/W at 300 W have been measured. In summary, microfabrication techniques have been employed to fabricate new, very high-performance liquid-cooled heat sinks having negligible volume (0.1 cm^3), and also to make a novel, stress-free, reusable microcapillary thermal interface between such heat sinks and integrated circuit substrates.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 19063

4210 Combustion Systems

REFER ALSO TO CITATION(S) 18030, 18322, 18403

18934 (DOE/ET/10393—1528) Performance of fuel feeding rotary valves. (NCB (IEA Grimethorpe) Ltd., Grimethorpe, Barnsley, South Yorkshire (UK)). Dec 1983. Contract AI01-76ET10393. 45p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84003058.

During the initial operation up to and including Test Series 1 at the Grimethorpe Experimental Pressurised Fluidised Bed Combustion Facility, a critical problem was maintaining stable fuel flow and resultant temperature stability. Rotary valves were installed in the fuel feed system after the completion of Test Series 1 for operation during the Hot Commissioning Tests in preparation for Test Series 2. The report outlines the successful operational history of the rotary valves up to the end of 1982. Details of the valve design and control system are given as well as a description of the modifications made to the valves following operational experience gained during the Hot Commissioning Tests.

18935 (DOE/MC/19330—1393) Advanced design for pulsed atmospheric fluidized bed combustion. Final report. Moussa, N.A.; Fowle, A.A.; Delichatsios, M.M.; Caron, R.N.; Wilson, R.P. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Dec 1982. Contract AC21-82MC19330. 96p. NTIS, PC A05/MF A01. Order Number DE83008081.

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In a pulsed bed, the fluidizing air is made to oscillate while flowing through the bed. The objectives of the work reported were to investigate the potential advantages and limitations of a pulsed atmospheric fluidized bed combustor, based on existing data and analyses, to develop conceptual bench-scale designs, and to formulate a research and development plan for experimental validation and development of the pulsation concept for improving the performance of an AFBC. (LEW)

18936 **(DOE/PC/30214—T7) Heat transfer in freeboard region of fluidized beds.** Biyikli, S.; Tuzla, K.; Chen, J.C. (Lehigh Univ., Bethlehem, PA (USA). Inst. of Thermo-Fluid Engineering and Science). Oct 1983. Contract FG22-80PC30214. 196p. NTIS, PC A09/MF A01. Order Number DE84004615.

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This research involved the study of heat transfer and fluid mechanic characteristics around a horizontal tube in the freeboard region of fluidized beds. Heat transfer coefficients were experimetnally measured for different bed temperatures, particle sizes, gas flow rates, and tube elevations in the freeboard region of air fluidized beds at atmospheric pressure. Local heat transfer coefficients were found to vary significantly with angular position around the tube. Average heat transfer coefficients were found to decrease with increasing freeboard tube elevation and approach the values for gas convection plus radiation for any given gas velocity. For a fixed tube elevation, heat transfer coefficients generally increased with increasing gas velocity and with high particle entrainment they can approach the magnitudes found for immersed tubes. Heat transfer coefficients were also found to increase with increasing bed temperature. It was concluded that this increase is partly due to increase of radiative heat transfer and partly due to change of thermal properties of the fluidizing gas and particles. To investigate the fluid mechanic behavior of gas and particles around a freeboard tube, transient particle tube contacts were measured with a special capacitance probe in room temperature experiments. The results indicated that the tube surface experiences alternating dense and lean phase contacts. Quantitative information for local characteristics was obtained from the capacitance signals and used to develop a phenomenological model for prediction of the heat transfer coefficients around freeboard tubes. The packet renewal theory was modified to account for the dense phase heat transfer and a new model was suggested for the lean phase heat transfer. Finally, an empirical freeboard heat transfer correlation was developed from functional analysis of the freeboard heat transfer data using nondimensional groups representing gas velocity and tube elevation.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 18071

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 17981, 17982, 18408, 18410

18937 **(PB—84-133016) Current status of commercial utility flue gas desulfurization systems. Final report, April 1982-April 1983.** Behrens, G.P.; Dickerman, J.C. (Radian Corp., Austin, TX (USA)). Dec 1983. 234p. NTIS, PC A11/MF A01.

The report discusses the current status of commercial flue gas desulfurization (FGD) processes applied to coal-fired utility boilers in the U.S. Major objectives of the work were to examine the impacts of the 1979 New Source Performance Standards on FGD system design and operation, and to identify recent improvements in the technology. Nearly all new systems are being built with spare absorber modules, to qualify for the NSPS emergency bypass provisions. The remaining throwaway and regenerable systems have not experienced any significant increases in application. Finally, organic acid addition has been successfully demonstrated on limestone systems to improve SO_2 removal and system reliability. It is being used at two sites to upgrade older systems.

4250 Power Cycles

18938 **Intrinsically irreversible heat engine.** Wheatley, J.C.; Swift, G.W.; Migliori, A. US Patent Application 6-445,650. 1984. 42p. Contract W-7405-ENG-36.

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A class of heat engines based on an intrinsically irreversible heat transfer process is disclosed. In a typical embodiment the engine comprises a compressible fluid that is cyclically compressed and expanded while at the same time being driven in reciprocal motion by a positive displacement drive means. A second thermodynamic medium is maintained in imperfect thermal contact with the fluid and bears a broken thermodynamic symmetry with respect to the fluid. The second thermodynamic medium is a structure adapted to have a low fluid flow impedance with respect to the compressible fluid, and which is further adapted to be in only moderate thermal contact with the fluid. In operation, thermal energy is pumped along the second medium due to a phase lag between the cyclical heating and cooling of the fluid and the resulting heat conduction between the fluid and the medium. In a preferred embodiment the engine comprises an acoustical drive and a housing containing a gas which is driven at a resonant frequency so as to be maintained in a standing wave. Operation of the engine at acoustic frequencies improves the power density and coefficient of performance. The second thermodynamic medium can be coupled to suitable heat exchangers to utilize the engine as a simple refrigeration device having no mechanical moving parts. Alternatively, the engine is reversible in function so as to be utilizable as a prime mover by coupling it to suitable sources and sinks of heat.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

18939 **(BNL—34268) BNL RFQ.** Giordano, S.T. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 5p. (CONF-831180—26). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007391.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

A brief outline of the theoretical design has been presented at the Symposium. Particular emphasis has been placed on the rf design of the main cavity, end cells, and power feed. The relevance of the design has been considered with respect to the tuning and operating characteristics of the structure.

18940 **CERN Annual Report. (Annual report 1982 of the European Organization for Nuclear Research).** Geneva, Switzerland; European Organization for Nuclear Research (1983). vp. European Organization for Nuclear Research, Geneva (Switzerland).

This annual report contains a description of the organization of CERN together with short descriptions of the work done at the single facilities and a list of publications.

4302 Beam Dynamics, Field Calculations, And Ion Optics

18941 **(AD-A—135120/4) Interim scientific report on virtual cathode oscillations. Report for 1 Jul 82-30 Jun 83.** Coutsias, E.A. (New Mexico Univ., Albuquerque (USA). Dept. of Mathematics and Statistics). 30 Jun 1983. 5p. NTIS, PC A02/MF A01.

During this period, the single investigator produced two papers with titles, Effects of Thermal Spread on the Space Charge Limit of an Electron Beam, and The Aging of Nuclei in a Binary Mixture. In progress is a paper dealing with the cascade of bifurcations due to delay effects related to the two stream model for virtual cathode formation in its simplest form. A paper, Kapitza-Dirac Scattering, is being written for publication. This report summarizes progress made under the grant during the specified period.

18942 **(AD-A—135533/8) Numerical simulations of the NRL collective particle accelerator. Final report 1 Jul-31 Dec 83.** Barker, R.J. (Mission Research Corp., Alexandria, VA (USA)). Nov 1983. 108p. NTIS, PC A06/MF A01.

Two-dimensional, electromagnetic, particle-in-cell numerical simulations of the NRL Collective Particle Accelerator (CPA) have been completed using the MAGIC code. Employing parameters which closely approximated the actual experiment, these simulations reveaed the spontaneous formation of a virtual cathode

which severely limited the net current flowing in the central beam of the device. These results explain experimental observations and indicate possible modifications which might make the CPA operational.

18943 **(AD-A—135940/5) Toroidal self-field corrections to the linear dispersion relation for the negative mass instability in a modified betatron.** Godfrey, B.B.; Hughes, T.P.; Campbell, M.M. (Mission Research Corp., Albuquerque, NM (USA)). Nov 1983. 17p. NTIS, PC A02/MF A01.

Negative mass instability growth rates determined from three-dimensional pic code simulations of high current modified betatrons do not agree particularly well with available linear theory, as noted in a companion paper. Published linear analyses of the negative mass instability treat particle dynamics in toroidal geometry but the electromagnetic fields in cylindrical geometry. The authors have, therefore, developed a new model employing toroidal fields; it is valid or arbritary toroidal mode numbers and a variety of accelerator cavity minor cross sections. The beam minor radius is assumed small compared to that of the cavity. Derivation of the dispersion relation and numerical solutions of it will be presented.

18944 **(ANL-HEP-CP—84-04) Determination of first-order machine parameters from particle physics requirements. Group 1. Summary report. Primary parametric relationships. I.** Diebold, R. (Argonne National Lab., IL (USA)). 19 Jan 1984. Contract W-31-109-ENG-38. 23p. (CONF-831264—11). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007302.

From Workshop on accelerator physics issues for a superconducting super collider; Ann Arbor, MI, USA (12 Dec 1983).

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High luminosity will be necessary for the study of many of the new phenomena expected in the SSC energy region. Particle detectors, however, are limited in the number of simultaneous interactions which they can handle, and thus need a good duty cycle with collisions spread out in time to the greatest extent possible. To avoid the larger number of stored protons required for continuous beams, we have considered bunched beams of protons crossing at a small angle. Plots are given of the dependence on bunch separation of the emittance, number of protons, etc., needed for 10^{33} cm^{-2} sec^{-1}. In order to minimize the number of stored protons ($\sim 10^{14}$/ ring), an emittance roughly ten times smaller than that presently achieved at high energies is required for a bunch separation of 6 meters (20 nsec).

18945 **(BNL—34340) Collective instabilities and high-gain regime free electron laser.** Bonifacio, R.; Pellegrini, C.; Narducci, L.M. (Brookhaven National Lab., Upton, NY (USA); Drexel Univ., Philadelphia, PA (USA). Dept. of Physics and Atmospheric Science). 1983. Contract AC02-76CH00016. 24p. (CONF-8309118—8). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008172.

From Topical meeting on free electron generation of extreme ultraviolet coherent radiation; Upton, NY, USA (19 Sep 1983).

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The operation of Free Electron Lasers (FEL) in the short wavelength region, $\lambda < 1000$ A, requires a large field amplification per undulator pass in order to overcome the large losses of the optical cavity at these wavelengths. Systems based on the combination of a storage ring and of a free electron laser can provide this large amplification. In fact, for these systems small-signal gains of the order of 100 to 1000% per pass have been estimated. Of course, at this level of amplification, the small-signal gain formula is no longer appropriate and a more accurate description of the FEL is required. FEL studies in the high-gain regime have been carried out by many authors who have shown that, with an appropriate selection of the electron density, detuning, and undulator length, it is possible to produce an exponential growth of both the radiation field and of the electron bunching. This is the result of the emergence of a collective instability for the electron beam-undulator-radiation field system. The conditions for the onset of this instability were studied and the characteristic complex frequencies of the FEL system are derived.

18946 **(DESY—83-073) 'Single mode cavities' a possibility for fighting collective beam instabilities.** Weiland, T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750899.

Copper acceleration cavities are usually optimized with respect to an optimum shunt impendance for the accelerating mode. Design criteria for superconducting cavities are different but in both cases the parasitic higher modes are often not taken into account as a priori design considerations. Transient wake fields and higher resonant modes also cause various serious types of instability and result in severe performance limitations for many existing and planned accelerators. Now that complete analysis of cavities has become possible by means of the programs TBCI and URMEL, cavities may be optimized for various requirements. As one result of such an optimization we present a cavity which has only one single axially symmetric mode: the accelerating one. At the same time the transient wake field effects in this cavity are significantly reduced.

18947 **(LBL—17020) Tune shifts due to systematic errors in bend magnets.** Douglas, D. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 45p. (CONF-831264—9). NTIS, PC A03; 3; GPO Dep. Order Number DE84006767.

From Workshop on accelerator physics issues for a superconducting super collider; Ann Arbor, MI, USA (12 Dec 1983).

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The presence of systematic error multipoles in bend magnets, persistent currents at low magnet excitation, and saturation effects at high magnet excitation may all lead to tune shifts which could prove detrimental to the operation of the SSC. It is the purpose of this note to report estimates of the magnitude of these tune shifts and the corrector strengths required to circumvent them.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 18896, 18998, 19440

18948 **(BNL—34235) Ionization of polarized hydrogen atoms.** Alessi, J.G. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 14p. (CONF-831180—23). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007378.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

Methods are discussed for the production of polarized H^- ions from polarized atoms produced in ground state atomic beam sources. Present day sources use ionizers of two basic types - electron ionizers for H^+ Vector production followed by double charge exchange in a vapor, or direct H^- Vector production by charge exchange of H^0 with Cs^0. Both methods have ionization efficiencies of less than 0.5%. Ionization efficiencies in excess of 10% may be obtained in the future by the use of a plasma ionizer plus charge exchange in Cs or Sr vapor, or ionization by resonant charge exchange with a self-extracted D^- beam from a ring magnetron or HCD source. 36 references, 4 figures.

18949 **(BNL—34239) Generation of intense polarized beams by selective neutralization of negative ions.** Hershcovitch, A.I.; Hinds, E.A. (Brookhaven National Lab., Upton, NY (USA); Yale Univ., New Haven, CT (USA). Dept. of Physics). 1983. Contract AC02-76CH00016. 7p. (CONF-831180—25). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007377.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

A novel scheme is proposed. This method is based on selective neutralization by laser negative hydrogen ions in a magnetic field. This selectivity is based on the fact that the final state of the neutralized atom depends on nuclear polarization in the magnetic field. A two-scenario approach is to be followed: one in which the

resulting neutral atom is in the ground state, and in the other the neutral atom is in the n = 2 level. Limiting factors are discussed. The main advantages of this scheme are the availability of multi-ampere negative ion sources and the possibility to neutralize negative ions with very high efficiency. 15 references, 2 figures.

18950 **(CONF-840263—2) Sample environments at IPNS: present and future capabilities.** Faber, J. Jr. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007269.

From Workshop on samples environments in neutron and x-ray experiments; Grenoble, France (13 Feb 1984).

Argonne's Intense Pulsed Neutron Source, IPNS, was dedicated as a major user-oriented neutron scattering facility two years ago. Most instruments are now equipped to provide for sample environments in the temperature range 1.5 < T < 1300K. A special facility provides T < 1mK, and another provides pressures to 30kbar. Several environmental equipment designs are described that emphasize time-of-flight technique. Methods for achieving time-resolved experiments which take advantage of the IPNS pulsed source characteristics are discussed. 6 references, 7 figures.

18951 **(DESY—83-058) New practicable Siberian Snake schemes.** Steffen, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750249.

Siberian Snake schemes can be inserted in ring accelerators for making the spin tune almost independent of energy. Two such schemes are here suggested which lend particularly well to practical application over a wide energy range. Being composed of horizontal and vertical bending magnets, the proposed snakes are designed to have a small maximum beam excursion in one plane. By applying in this plane a bending correction that varies with energy, they can be operated at fixed geometry in the other plane where most of the bending occurs, thus avoiding complicated magnet motion or excessively large magnet apertures that would otherwise be needed for large energy variations. The first of the proposed schemes employs a pair of standard-type Siberian Snakes, i.e. of the usual 1st and 2nd kind which rotate the spin about the longitudinal and the transverse horizontal axis, respectively. The second scheme employs a pair of novel-type snakes which rotate the spin about either one of the horizontal axes that are at 45° to the beam direction. In obvious reference to these axes, they are called left-pointed and right-pointed snakes.

18952 **(DOE/SF/00515—T27) Stanford Linear Accelerator Center monthly report for February 1984.** (Stanford Linear Accelerator Center, CA (USA)). Feb 1984. Contract AC03-76SF00515. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007675.

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Operational activities for the month of February 1984 are reported in the areas of accelerator and research operations, research area and experiment status, accelerator improvements, research division developments, PEP division developments, and publications for the month. (GHT)

18953 **(GSI—83-4) Experiment data acquisition and analysis system. Vol. 1.** Busch, F.; Croome, D.; Goeringer, H.; Hartmann, V.; Lowsky, J.; Marinescu, D.; Richter, M.; Winkelmann, K. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1983. 203p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84750508.

The Experiment Data Acquisition and Analysis System EDAS was created to acquire and analyze data collected in experiments carried out at the heavy ion accelerator UNILAC. It has been available since 1975 and has become the most frequently used system for evaluating experiments at GSI. EDAS has undergone constant development, and the many enhancements make this completely revised third edition of the EDAS manual necessary. EDAS consists of two sub-systems: GOLDA for experimental data acquisition on PDP-11's and SATAN mainly for off-line analysis in replay mode on large IBM mainframes. The capacity of one IBM 3081 CPU is mainly dedicated to EDAS processing and is almost fully utilized by this application. More than 200 users from GSI as well as from collaborating laboratories and universities use SATAN in more than 100 sessions daily needing 10 to 20 hours of user CPU time. EDAS is designed as an open system.

18954 (INIS-SU—198, pp vp) **Improvement of the ^{3}He polarized target characteristics using a laser.** Yasnogorodskij, A.M. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

18955 **(LAL-RT—83-03) Adiabatic matching device for the Orsay linear positron accelerator.** Chehab, R.; Le Meur, G.; Mouton, B.; Renard, M. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Mar 1983. 3p. (CONF-830311—189). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700124.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

An adiabatically tapered solenoidal magnetic field is used to match positron beam source emittance to accelerating section acceptance. Such a matching system improves the accepted energy band which has been accurately computed and compared with analytical determination. The tapered field is provided by stacked pancakes and solenoids of various radii; total lens length is about 0.75m. The adiabatic matching system took the place of a quarter wave transformer system and has been in operation for two years. Positron conversion ratio is 3.3% for a 1 GeV incident beam and presents a factor of improvement of nearly two for the positron yield. Energy bandwidth of the positron beam has also been increased by a factor of nearly 2.5; the output positron beam energy is of 1.2 GeV.

18956 **(NIIEFA-P-B—0580) Optimization of the front part configuration of a superconducting dipole magnetic with a saddle-shaped coil.** Eregin, V.E.; Sychevskij, S.E.; Titov, V.A. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700126.

Optimization of the front part configuration of the superconducting dipole (SD) magnet UNK MPD-2-2 using numerical simulation of the SD spatial field is carried out. It is shown that the limitation of the field maximum modulus value at the front part by the pre-assigned level, the effective length being sufficiently unchanged, can be achieved by discharge introduction into the first turn winging of the low layer. A technologically convenient way of boundary nonlinearity compensation by changing the conductor bend configuration at the front part is suggested. The conductor bend configuration change at the front part does not result in essential change of maximum modulus value in the coil. This allows to optimize the front part configuration in absolute value of the field and boundary nonlinearity independently of each other.

18957 **(SLAC—96) SLAC users Bulletin No. 96, August-December 1983.** Keller, L.P.; Edminster, D. (eds.). (Stanford Linear Accelerator Center, CA (USA)). 1983. Contract AC03-76SF00515. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008182.

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Operational activities for the months of August through December 1983, are reported in the areas of accelerator and research operations, research area and experiment status, accelerator improvements, research division developments, PEP division developments, and publications for the month. (GHT)

4304 Storage Rings

18958 (CEA-CONF—6645) Recent results of the ACO storage ring. Billardon, M.; Ortega, J.M.; Deacon, D.A.G.; Elleaume, P.; Robinson, K.E.; Bazin, C.; Bergher, M.; Madey, J.M.J.; Petroff, Y.; Velghe, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1982. 45p. (CONF-821203—7). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700121.

From International conference on lasers; New Orleans, LA, USA (13 Dec 1982).

A permanent magnet undulator has been built and installed on the ACO Storage Ring. The undulator design, the spontaneous emission and gain of the system, as well as the laser induced bunch lengthening of the electron bunch, are presented. A low-loss optical cavity has been also recently built and operated on the ring. Its performance and the degradation problems of the mirrors are discussed. Amplification of the spontaneous emission stored in the optical cavity has been observed. Also, preliminary results on the operation of an optical klystron are reported and interpreted.

18959 (DESY—83-062) Theory of spin-orbit motion in electron-positron storage rings. Mais, H.; Ripken, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 75p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750890.

In the present report we present a highly condensed summary of our previous works in which we investigated the spin-orbit motion of particles in a storage ring. The starting points of these investigations are the Lorentz equation and the BMT equation. Having defined a suitable coordinate system and having described the external fields, the linearized equations of motion are derived. In the discussion of the orbital motion (which includes radiation damping and quantum excitations) the betatron oscillations and synchrotron oscillations are treated simultaneously. Explicit expressions for the transfer matrices of the orbital motion are given for the most important beam line elements (i.e. quadrupoles, drift spaces, rotated quadrupoles, solenoids, cavities, electric and magnetic dipole fields). In the appendix a numerical scheme is described for calculating the spin transfer matrices. Using Bogoliubov's averaging method the following physical quantities are calculated: i) damping constants of the synchro-betatron oscillations; ii) beam emittance matrix; iii) depolarization time due to quantum fluctuations of the radiation. Finally, we show how one can express these quantities in terms of the dispersion.

18960 (DESY—83-065) Progress in measurement and understanding of beam polarization in electron positron storage rings. Barber, D.P.; Bremer, H.D.; Kewisch, J.; Lewin, H.C.; Limberg, T.; Mais, H.; Ripken, G.; Rossmanith, R.; Schmidt, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750252.

A report is presented on the status of attempts to obtain and measure spin polarization in electron-positron storage rings. Experimental results are presented and their relationship to predictions of calculations discussed. Examples of methods for decoupling orbital and spin motion and thus improving polarization are discussed.

18961 (LAL-RT—83-01) Almost stationary direction of polarisation in an electron storage ring. Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Jan 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700122.

It is shown that, in presence of synchrotron and betatron oscillations, there exists a quasi-stationary direction of spin with respect to spin precession, along which polarisation is built-up by the Sokolov-Ternov effect. The variation of this quasi-stationary direction, under quantum fluctuations, give the spin-orbit coupling in an equivalent way to the ultimate deviation of spin after damping.

18962 (LAL-RT—83-02) More on depolarisation enhancement due to large energy spread. Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Feb 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700123.

The depolarisation enhancement factor, due to large energy spread, is calculated for a superimposition of several integer resonances, using a 1st order perturbation method as previously for a single resonance. It is shown that the enhancement factors of these resonances add up incoherently. Numerical estimates are given for LEP at 51.5 GeV. Reduction of spin chromaticity is discussed.

18963 (LAL-RT—83-04) Exact suppression of depolarisation by beam-beam interaction in an electron ring. Buon, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Mar 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700125.

It is shown that depolarisation due to beam-beam interaction can be exactly suppressed in an electron storage ring. The necessary "spin matching" conditions to be fulfilled are derived for a planar ring. They depend on the ring optics, assumed linear, but not on the features of the beam-beam force, like intensity and nonlinearity. Extension to a ring equipped with 90° spin rotators is straight forward.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 18810

18964 (AD-A—135061/0) Maximum likelihood reconstruction in emission tomography with time-of-flight information: a limited study. Technical report. Kaufman, L.; Morgenthaler, S.; Vardi, Y. (Massachusetts Inst. of Tech., Cambridge (USA). Statistics Center). Oct 1983. 20p. NTIS, PC A02/MF A01.

The maximum likelihood reconstruction for positron emission tomography (PET) and its use in connection with time-of-flight (TOF) tomography are reviewed and the issue of trade-off between information and data (that is, time of flight information vs. additional coincidence count data) is explained. The maximum likelihood technique is then used to qualitatively assess this trade-off by means of visually comparing reconstructions. Specifically, the authors use computer simulation to generate data of PET experiments with a fixed emission density Lambda and with varying amounts of TOF information and total coincidence count data. The maximum likelihood technique is then used to reconstruct Lambda on the bases of these data sets and the different reconstructions are displayed and compared.

18965 (AD-A—135803/5) Study of the characteristics of high pressure proportional counters for the detection of radioactive noble gases. Master's thesis. Knapp, J.J. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1983. 107p. (AFIT/GNE/PH—83M-8). NTIS, PC A06/MF A01.

This report presents a study of the design and operating characteristics of high pressure proportional counters for the detection of radioactive noble gases. The analysis was limited to those radioisotopes of xenon, 131mXe and 133Xe, which are produced in nuclear fission. The detector may be utilized for the identification of the radionuclide 133Xe through conversion electron analysis. A sample of 133Xe was measured at 41 atmospheres using xenon as the counting gas; the resolution (FWHM) for the 45 keV conversion electron and 75.6 keV sum peak were found to be 5.9 keV and 7.0 keV respectively. The extreme sensitivity of noble gases to electronegative impurities was also found; a periodic or perhaps continuous purification of the counting gas may be required for stable and reproducible resolution. Recommendations were made for further study.

18966 **(AD-A—135864/7) Factors affecting the application of a simple ratio technique for spectral correction of a neutron personnel albedo dosimeter. Doctoral thesis.** Nelson, R.C. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Nov 1983. 104p. NTIS, PC A06/MF A01.

To accurately assess the dose equivalent indicated by the albedo response of a neutron personnel dosimeter, additional knowledge is generally required in order to apply the needed spectral specific correction factors. This work was designed to evaluate the capability of the USAF Personnel Neutron Dosimeter to self-calibrate for moderated fission neutron spectra. The boron/bare ratio technique is compared with a simple theoretical model of the dosimeter and with the 23 cm (9 in) to 7.6 cm (3 in) Hankins' remmeter calibration technique. The overall goal was to provide dose-equivalent estimates comparable to those provided by the remmeter technique without the necessity of special on-site measurements. Although the boron/bare technique with the present dosimeter fails to provide calibration factors needed for moderated fission neutron spectra, theoretical predictions based upon the model and the measured dosimeter responses are used to propose a dosimeter design which might fulfill the desired goal. Ancillary data gathered during the study are also presented.

18967 **(AD-A—136157/5) Shuttle flight test of an advanced gamma-ray detection system. Final scientific report, 1 January 1982-31 March 1983.** Rester, A.C. Jr. (Florida Univ., Gainesville (USA). Space Astronomy Lab.). Nov 1983. 11p. NTIS, PC A02/MF A01.

A detector system consisting of an n-type, high-purity germanium detector in a bismuth germanate anticompton shield has been developed for flight on a space shuttle mission. The BGO shield consists of six trapezoidal segments, each one being 14.6 cm long by 2.74 cm thick, mounted in a hexagonal shape about the axis of the germanium detector can.

18968 **(ANL/EV/AP—84-1) Some aspects of the use of proton recoil proportional counters for fast neutron personnel dosimeters.** Yule, T.J.; Bennett, E.F. (Argonne National Lab., IL (USA)). Jan 1984. Contract AC05-84OR21400. 39p. NTIS, PC A03.

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Gas-filled proton recoil proportional counters have been used extensively for the measurement of neutron spectra in degraded fission-spectrum environments. Some considerations relating to the use of these counters for personnel dosimetry are here described. High sensitivity and good accuracy in the determination of dose-equivalent can be obtained if relatively high pressure hydrogen-filled proportional counters are used as the active element in a dosimeter system.

18969 **(ANL/EV/AP—84-2) Neutron spectrum measurements using proton recoil proportional counters: results of measurements of leakage spectra for the Little Boy assembly.** Bennett, E.F.; Yule, T.J. (Argonne National Lab., IL (USA)). Jan 1984. Contract W-31-109-ENG-38. 33p. NTIS, PC A03 ; 3; GPO Dep. Order Number DE84009050.

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Measurements of degraded fission-neutron spectra using recoil proportional counters are done routinely for studies involving fast reactor mockups. The same techniques are applicable to measurements of neutron spectra required for personnel dosimetry in fast neutron environments. A brief discussion of current applications of these methods together with the results of a measurement made on the LITTLE BOY assembly at Los Alamos are here described.

18970 **(CEA-R—5213(pt.1)) Flowrate measurement method by counting of radioactive particles suspended in a liquid. Application: flowrate measurement of lubricating oil at the bearings of the bit brace of an automobile engine.** Daniel, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1983. 190p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84700112.

By external counting of fine γ emitting radioactive particles suspended in a liquid, the flowrate in a system of pipes can be measured. The study comprises three phases: 1. - The hydraulic validity of the method is demonstrated in laminar as well as in turbulent flow under certain conditions of particle size and density and of liquid viscosity. 2. - Radioactive labelling of microspheres of serum albumin or ion exchange resins with indium 113m delivered by a generator Tin 113 → Indium 113m. 3. - Counting with a scintillation detector: a method of threshold overstepping is experimented with a mechanical or electronic simulator; the statistical study of particle superposition under the detector enables a correction for the resulting counting losses to be proposed. The method provides absolute measurements, but is particularly suitable to measure relative flowrates in a hydraulic network. It can be continuous and does not perturb the flow and the network. The accuracy of the method is analysed in detail.

18971 **(CEA-R—5213(Pt.2)) Flowrate measurement method by counting of radioactive particles suspended in a liquid. Application: flowrate measurement of lubricating oil at the bearings of the bit brace of an automobile engine.** Daniel, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1983. 230p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE84700113.

This volume only contains the figures and tables of the thesis (see CEA-R--5213(pt.1).

18972 **(CONF-840202—18) Computer-controlled system for rapid soil analysis of ^{226}Ra.** Doane, R.W.; Berven, B.A.; Blair, M.S. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007562.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

A computer-controlled multichannel analysis system has been developed by the Radiological Survey Activities Group at Oak Ridge National Laboratory (ORNL) for the Department of Energy (DOE) in support of the DOE's remedial action programs. The purpose of this system is to provide a rapid estimate of the ^{226}Ra concentration in soil samples using a 6 x 9-in. NaI(Tl) crystal containing a 3.25-in. deep by 3.5-in. diameter well. This gamma detection system is controlled by a mini-computer with a dual floppy disk storage medium. A two-chip interface was also designed at ORNL which handles all control signals generated from the computer keyboard. These computer-generated control signals are processed in machine language for rapid data transfer and BASIC language is used for data processing.

18973 **(DOE/ER/10418—3) Response simulation of a position-sensitive neutron detector using a computer program.** Boonyapat, B. (Georgia State Univ., Atlanta (USA)). 1983. Contract AS05-79ER10418. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008384.

Portions are illegible in microfiche products; Thesis.

The purpose of this thesis was to simulate the response of a position-sensitive neutron detector through the use of a computer program. Using identical dimensions, three basic designs were simulated: (1) a clear quartz tube for which photons incident on the outer surface of the quartz at angles less than the critical angle are discarded; and (2) a tube whose inner surface is highly polished producing specular reflections; and (3) a tube whose inner surface is coated with a highly reflective white surface. An optimized organic liquid scintillator, NE213, detector has been built using design (1) and tested at Oak Ridge National Laboratory. The results were analyzed using a refined version of the computer program of Permin Netter. The program tested the three designs to determine which design produces the largest light collection for neutrons detected near the center of the detector and which produces the most uniform response over the tube length. RCA 8854 photomultiplier tubes were used to measure the neutron energies of a ^{252}Cf fission source. Using time-of-flight techniques and Monte Carlo simulation it was determined that: (1) a clear quartz (glass) tube is preferred. However, its counter properties are slightly improved with a cladding having a large reflective coefficient around the tube. This allows photons not to reach the limiting angle but be reflected into

the exterior space to be retained for light gathering. Results were expressed in terms of light output in percent and position in centimeters; (2) the n-efficiency is slightly greater at the ends of the tube than at the middle of the tube.

18974 **(DOE/ER/10550—6) Particle identification by electronic sampling of ionization loss. Final report, September 1, 1979-January 15, 1984.** Lindenbaum, S.J. (City Coll., New York (USA)). 1984. Contract AC02-79ER10550. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009102.

High Energy Particle Identification by Ionization Loss is a standard method. The conventional method used is to stack many gas ionization chambers each about 1 cm thick to form an ensemble of several meters. Approximately the higher half of the ionization loss pulses are discarded to reduce the effect of delta rays in the long Landau tail which seriously degrade the particle identification sensitivity. Approximately 1 cm is the least practical individual cell width. In this R and D project we have successfully shown that by an electronic sampling method which we developed sampling distances < 0.5 mm could be attained. This allows much more complete elimination of the softer delta rays and leads to approximately a factor of two improvements in the particle identification sensitivity (defined in report). We have experimentally demonstrated that the method works on small size prototypes. It is anticipated that this method will in future be employed by the author's group, other US groups, CERN, and Japanese groups at various present and future high energy accelerators.

18975 **(FERMILAB-Conf—84/22-E) Measurement of electromagnetic shower position and size with a saturated avalanche tube hodoscope and a fine grained scintillation hodoscope.** Rameika, R.; Cox, B.; Jenkins, C.M.; Judd, D.J.; Hale, G.; Mazur, P.O.; Murphy, C.T.; Turkot, F.; Wagoner, D.E.; Conetti, S. (Fermi National Accelerator Lab., Batavia, IL (USA); McGill Univ., Montreal, Quebec (Canada); Stanford Linear Accelerator Center, CA (USA); Shandong Univ., Jinan (China)). Jan 1984. Contract AC02-76CH03000. 11p. (CONF-831015—39). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007247.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

A hodoscope has been constructed from 100 μ m diameter wires and brass tubes (1.2 x 0.7 cm^2 cross section) filled with a mixture of argon, ethane and ethyl alcohol. It has been tested in the saturated avalanche mode in an SCG1-C electromagnetic shower detector to determine its properties for the measurement of the position and size of electromagnetic showers. Two of these tube hodoscopes were positioned 3.5 radiation lengths deep in the detector and the profiles of 1 to 25 GeV electromagnetic showers were measured. Simultaneous measurements were performed using a plane of twenty, 0.5 cm wide scintillation counters positioned immediately behind the gas tube hodoscope. In addition the transition between saturated avalanche and limited streamer modes has been measured for the tube hodoscopes.

18976 **(FERMILAB-Conf—84/23-E) Measurement of the response of an SCGl-C scintillation glass array to a 4-14 GeV/c pions.** Cox, B.; Jenkins, C.M.; Judd, D.J.; Hale, G.; Mazur, P.O.; Murphy, C.T.; Rameika, R.; Turkot, F.; Wagoner, D.E.; Conetti, S. (Fermi National Accelerator Lab., Batavia, IL (USA); McGill Univ., Montreal, Quebec (Canada); Stanford Linear Accelerator Center, CA (USA); Michigan State Univ., East Lansing (USA); Athens Univ. (Greece)). Jan 1984. Contract AC02-76CH03000. 14p. (CONF-831015—38). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007248.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1983).

An SCGl-C scintillation glass detector consisting of a 3.5 radiation length SCGl-C active converter followed by scintillation and gas tube hodoscopes and a 4 x 4 array of a 20.5 radiation length SCGl-C counters has been exposed to pions in the 4 to 14 GeV/c momentum range. The response of this detector to pions is compared with the response to electrons of the same momentum in order to distinguish between the two types of particles. Using only longitudinal and tranverse shower development criteria the electrons and pions can be separated such that on average 1.1×10^{-1} of all pions in the range of 4 to 14 GeV/c would be misidentified as electrons of any energy. If the momentum of the incident particle is known and can be used in the identification technique, this average fraction is reduced to 6.4×10^{-3} of all pions misidentified as electrons of the same momentum.

18977 (INIS-mf—8703, pp vp) **Neutron optics on reactor IBR-2 in JINR, Dubna - project "DIFRAN".** Aleksandrov, Yu.A.; Machekhina, T.A.; Michalec, R.T.; Sedlakova, L.N.; Vrana, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics); Chalupa, B.; Kulda, J.; Mikula, P. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

18978 (INIS-mf—8703, pp vp) **Use of multiple reflections in deformed crystals in new types of neutron monochromators.** Mikula, P.; Kulda, J.; Vrana, M.; Michalec, R.T. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

18979 **(KFK—3580) Calculated efficiency of a 4 π detector of BGO or BaF_2 for monoenergetic gamma rays and gamma cascades following neutron capture.** Wisshak, K.; Kaeppeler, F.; Schatz, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kern- und Teilchenphysik). Sep 1982. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750517.

The applicability of a spherical shell of BGO or BaF_2 as a 4π detector for high precision measurements of neutron capture cross sections was investigated. First the efficiency of both scintillator materials for monoenergetic gamma rays was calculated in the energy range from 0.5 to 10 MeV. Configurations with different thicknesses and inner radii were considered. Second, neutron capture cascades were calculated for several isotopes with widely different capture gamma ray spectra according to the statistical model. Both informations together allowed to determine the efficiency of an actual detector for neutron capture events in dependence of the threshold energy. A thickness of 10 cm BGO or 17.5 cm BaF_2 proved to be sufficient to registrate more than 95% of all capture events above a threshold energy of 3 MeV. This reduces the systematic uncertainty due to the detector efficiency in an absolute cross section measurement to less than 1% and in a relative measurement using a gold standard to less than 0.5%.

18980 **(KIYI—81-10) Semiconductor detector application in nuclear physics experiments.** (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780048.

Separate abstracts were prepared for ten papers in this report.

18981 **(OEFZS—4231) Radiometric sensors. New applications - improved technology.** Donhoffer, D. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Jul 1983. 19p. (In German). (IA—117/83). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700114.

Radiometric sensors are based upon the interaction between radiation emitted from a radioisotope source and the material to be measured. Various material parameters, such as density, mass per unit area, elementary composition, moisture, may be measured depending upon the choice of the radiation source, the kind of interaction observed and the measuring geometry. Quite a few measuring techniques could be realised only recently since the availibility of microprocessors which are used to evaluate the often complicated functional dependence between the measured value and the radiation signal obtained. In the present paper three examples are given for application of radiometric sensors, covering a wide range, from the measuring technique as well as on the side of the application.

18982 **(PB—84-119932) Evaluation of track-etch (trade name) detectors.** Savage, E.D. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Sep 1983. 34p. (EPA—520/5-83-020). NTIS, PC A03/MF A01.

A study was conducted to evaluate the precision and accuracy of Track-Etch (R) passive radon detectors manufactured by the Terradex Corporation. Four configurations of these detectors were exposed to known radon concentrations in the Eastern Environmental Radiation Facility radon chamber under varying exposure regimines and sent to Terradex for processing and readout. Data reported by Terradex and our own exposure concentrations were used to calculate calibraation numbers for each configuration which were then compared to calibration numbers used by Terradex. Results of our study indicate that groups of detectors exposed together and processed together demonstrate similarity in response. Groups of detectors exposed and processed at different times, however, did not always agree with each other nor with published Terradex calibration numbers.

18983 **(PTB-ND—21) Theoretical concept for measuring doses from external radiation in radiation protection.** Siebert, B.R.L.; Hollnagel, R.; Jahr, R. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Neutronendosimetrie). Jun 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750732.

A previously published theoretical concept for measuring individual doses from external radiation in radiation protection is applied to the following topics: Film dosemeters in photon dosimetry, finite distances between the radiation sources and the exposed individual, calibration procedures for individual dosemeters in practical situations in which the dosemeter can be calibrated for only a finite set of energy spectra and directions of incident radiations.

18984 (ZfI-Mitt—70, pp 140-149) **Measurement of fluorocarbons with electron-capture detectors.** Mothes, S.; Popp, P.; Oppermann, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Herberg, W.D. (VEB Zentrum fuer Forschung und Technologie Mikroelektronik, Dresden (German Democratic Republic)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Electron-capture detectors (ECD) enable the highly sensitive determination of fluorocarbons and fluorochlorocarbons. It is shown, that the investigation of gas chromatographic retention indices and electron-capture coefficients permits the identification of such compounds. Improved ECB modes (coulometric mode, electron attachment spectroscopy) are discussed.

18985 (ZfI-Mitt—70, pp 160-169) **Hydrocarbon-sensitized argon ionization detector for the detection of inorganic compounds.** Popp, P.; Arnold, G.; Oppermann, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Noble gas ionization detectors render possible to determine inorganic trace components in gases. Among the several modes of operation of these detectors the hydrocarbon-sensitized argon detector is a favourable compromise with regard to the relation of the expense to the attainable detection limit. The suitability of this detector for the determination of H_2, O_2, N_2, CH_4 and CO_2 in pure gases is shown.

18986 **Deterministic methods for the analysis of logging problems.** McDaniel, P.J.; Harris, J.M. (Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **45**: 217-218(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

18987 **Progress in energy resolution of mercuric iodide (HgI_2) X-ray spectrometers.** Dabrowski, A.J.; Szymczyk, W.M.; Iwanczyk, J.S.; Kusmiss, J.H. (University of Southern California, Marina Del Rey (USA). Inst. for Physics and Imaging Science); Drummond, W.; Ames, L. (Tracor Xray Inc. Mountain View, CA (USA)). *Nuclear Instruments and Methods in Physics Research;* **213**: No. 1, 89-94(15 Jul 1983). (CONF-820667—).

From 5. international workshop on HgI/sub 2/ nuclear radiation detectors; Jerusalem, Israel (6 Jun 1982).

A brief discussion of the main factors which affect the energy resolution of HgI_2 X-ray spectrometers is presented. A short review of the progress made in the process of improving the energy resolution is given. The latest experimental results obtained with a state-of-the-art cryogenically cooled low-noise preamplifier are shown. Ways of lowering the currently attainable room-temperature electronic noise level other than cryogenic cooling are discussed.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

18988 **(AD-A—135789/6) Investigation of the basic mechanisms of radiation effects on electronics and development of radiation hardening procedures. Volume 1. Final report 1 Jan 81-1 Jan 82.** Othmer, S.; Srour, J.R.; Shanfield, Z.; Hartmann, R.A.; Hopkins, M.A. (Northrop Research and Technology Center, Palos Verdes Peninsula, CA (USA)). 1 Aug 1982. 92p. (NRTC—82-20R-VOL-1). NTIS, PC A05/MF A01.

This report describes results of a study of radiation effects on electronic materials, devices, and integrated circuits. Emphasis is placed on determining the basic mechanisms of the interaction of radiation with these materials and components with a view toward gaining understanding of benefit to developers of radiation-tolerant devices. Results of analytical and experimental studies of the mechanisms of neutron effects on VLSI structures are presented. The issue of whether a single neutron-produced defect cluster can produce a significant amount of permanent damage ('hand error') in a VLSI cell is addressed. The results obtained suggest that hard errors may occur at relatively modest neutron fluences. An experiment using a scanning electron microscope was initiated in which an attempt is being made to observe individual defect clusters through their effect on carrier recombination. Thermally stimulated current measurements have been performed on irradiated Si0 sub 2 films in order to obtain basic mechanisms information regarding the nature of hole traps at the Si0 sub 2-Si interface. A hole trap distribution ranging in energy (with respect to the valence band) from 9.7 to 1.3 eV was found, with energy peaks at 0.9 and 1.1 eV being tentatively assigned. An investigation of the effects of ionizing radiation on mercury cadmium telluride MIS devices has been performed. The net charge buildup measured in these devices following 77 K irradiation is attributed to the charge trapped in the interfacial region between the insulating film and the HgCdTe substrate.

18989 **(AD-A—135814/2) Analysis and testing of radiation-induced transient effects in complex microcircuits. Topical report 28 Jan 80-1 Jun 82.** Raymond, J.P. (Mission Research Corp., San Diego, CA (USA)). 1 Jun 1982. 130p. NTIS, PC A07/MF A01.

Analytical and experimental considerations in assessing transient effects of microcircuits exposed to a pulsed radiation environment are summarized tutorially with extensive references. The report represented the notes associated with lectures given at the 1981 and 1982 IEEE Radiation Effects Conference Short Course.

18990 **(AD-A—136393/6) Basic mechanisms of radiation effects on electronic materials, devices, and integrated circuits. Technical report.** Srour, J.R. (Northrop Research and Technology Center, Hawthorne, CA (USA)). 1 Aug 1982. 100p. (NRTC—82-21R). NTIS, PC A05/MF A01.

This report describes in a tutorial manner the basic mechanism of radiation effects on electronic materials, devices, and integrated circuits. Radiation effects in bulk silicon and in silicon devices are treated. Ionizing radiation effects in silicon dioxide films

and silicon MOS devices are discussed. Single event phenomena are considered. Key literature references and a bibliography are provided.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 18890

18991 (AD-A—134998/4) Test strategy for high resolution image scanners. Final technical report 13 Mar-15 Sep 83. Gruen, A.W. (Ohio State Univ., Columbus (USA). Dept. of Geodetic Science and Surveying). Oct 1983. 63p. NTIS, PC A04/MF A01.

The scope of this study is the design of a device-independent test strategy for performance tests of the AIDS(Advanced Image Digitizing System) scanner. Major system characteristics to be tested are the geometrical accuracy, linearity of gray shade response, MTF, and resolution of the output. Other parameters addressed here are dynamic range, noise, response uniformity, flare light, coherency, and temporal stability. Test standards are suggested and data processing aspects are considered for both the geometric and radiometric tests. The recommended test strategy is finally summarized in table format.

18992 (AD-A—135991/8) Thermal diffusivity in thin films measured by noncontact single-ended pulsed-laser-induced thermal radiometry. Technical report. Tam, A.C.; Leung, W.P. (International Business Machines Corp., San Jose, CA (USA). Research Lab.). 22 Nov 1983. 21p. (TR—5). NTIS, PC A02/MF A01.

A pulsed nitrogen laser is used to induce a sharp thermal gradient in a thin film, and the thermal radiation (infrared) transient from the irradiated region is monitored from the same side as the excitation beam (ie.e, single-ended detection). We show that this pulsed photothermal radiometry lineshape can be analyzed to provide the thermal diffusivity or thickness of the sample, as well as information on subsurface modifications or the degree of thermal contact with a substrate. We present data for several important classes of films, including metal, polymer and paper (e.g., in currency) and show the important features of the present technique for thin-film characterization, namely nondestructive, fast and remote sensing.

18993 (CONF-830887—4) Computer-assisted alignment of a Guinier x-ray powder diffraction system. Fitzpatrick, J.J.; Pressnall, J.S. (Denver Univ., CO (USA)). 1983. Contract AC02-81ER10896. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007891.

From Joint meeting of American Crystallographic Association and Denver X-ray conference; Snowmass, CO, USA (1 Aug 1983).

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Digitized data acquisition and subsequent peak-profile fitting are used in aligning and maintaining the Guinier diffraction system in this laboratory. Utilization of a stepping motor driven goniometer along with profile analysis allows rapid and reproducible alignment while providing a means to investigate the types and magnitudes of errors introduced by various misalignments of the optical system.

18994 (LA-UR—84-720) Performance of transition metal-carbon multilayer mirrors from 80 to 350 eV. Kania, D.R.; Bartlett, R.J.; Trela, W.J.; Spiller, E.; Golub, L. (Los Alamos National Lab., NM (USA); International Business Machines Corp., Yorktown Heights, NY (USA); Harvard-Smithsonian Center for Astrophysics, Cambridge, MA (USA)). Mar 1984. Contract W-7405-ENG-36. 6p. (CONF-840387—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007479.

From 2. topical meeting on laser techniques in the extreme ultraviolet; Boulder, CO, USA (5 Mar 1984).

We report measurements and theoretical calculations of the reflectivity and resolving power of multilayer mirrors made of alternate layers of a transition metal (Co, Fe, V, and Cr) and carbon (2d $\approx$ 140 A) from 80 to 350 eV.

18995 (LBL—16695) Development of neutron-transmutation-doped germanium bolometer material. Palaio, N.P. (Lawrence Berkeley Lab., CA (USA)). Aug 1983. Contract AC03-76SF00098. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008248.

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The behavior of lattice defects generated as a result of the neutron-transmutation-doping of germanium was studied as a function of annealing conditions using deep level transient spectroscopy (DLTS) and mobility measurements. DLTS and variable temperature Hall effect were also used to measure the activation of dopant impurities formed during the transmutation process. In additioon, a semi-automated method of attaching wires on to small chips of germanium (< 1 mm^3) for the fabrication of infrared detecting bolometers was developed. Finally, several different types of junction field effect transistors were tested for noise at room and low temperature ($\sim$ 80 K) in order to find the optimum device available for first stage electronics in the bolometer signal amplification circuit.

18996 (ORNL/TM—8852) Thermocouple tests: a quick-look report on failures during loss-of-fluid tests L2-6 (LOFT L2-6). Anderson, R.L.; Cannon, C.P. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84007777.

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Tests were conducted to determine the operating limits of fuel cladding thermocouples installed inside the fuel rods for the loss-of-fluid test (LOFT) F2 fuel bundle test. This investigation was conducted to determine (a) the range of time and temperature exposure over which reliable performance can be expected for the dual diameter, 0.040/0.020-in.-diam, Inconel-clad, MgO-insulated, type K thermocouples installed in the LOFT F2 fuel bundle, and (b) the effect of reactor fuel preconditioning at various reactor power levels. Grounded, ungrounded, and unjunctioned thermocouples were tested in temperature profiles estimated for reactor power levels of 8, 10, 12, and 14 kW/ft. The estimated peak temperature was 2160°F for the highest power level. The effects of fuel preconditioning for eight hours at peak temperatures of 1950°F were measured. The results showed that (a) in expected LOFT F2 temperature profiles, thermocouple read-out errors remained less than 1% up to a peak temperature of 1900 to 1950°F; (b) thermocouple read-out errors from virtual junction effects increase rapidly with temperatures above 1950°F; (c) wire breakage in peak temperature regions did not occur in any of the tests; and (d) thermocouple performance did not measurably improve nor degrade as a result of eight hours of preconditioning at 1950°F. The test data taken with the estimated profiles establish an upper bound on performance errors.

18997 (SAND—83-2477) Intercomparison of zinc freezing point cells and standard platinum resistance thermometers. Roberts, R.N. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1984. Contract AC04-76DP00789. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007440.

Four standard platinum resistance thermometers (SPRTs) and four zinc freezing-point cells are intercompared. Pronounced differences are found between the SPRTs but no differences are found between the cells. Analysis of data indicates interaction between cells and SPRTs in two instances. One interaction is found to be spurious because of an anomalous data point. No grounds are found for discounting the validity of the second interaction. Reasons are given for repeating this work after refinements in procedure and equipment are made.

18998 (SLAC-TN—84-1) Time domain reflectometry for SLC BPM system. Thompson, D.R. (Stanford Linear Accelerator Center, CA (USA)). Jan 1984. Contract AC03-76SF00515. 26p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009088.

This document is intended for use as a maintenance manual for troubleshooting installed SLC Beam Position Monitor stripline

assemblies and the associated cabling, using Time Domain Reflectometry.

18999 (ZfI-Mitt—70, pp 170-177) **Automatic dust monitor AMIZ.** Szepke, R.; Lisieski, W.; Harasimczuk, J. (Institute of Nuclear Research, Warsaw (Poland)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

Design, operation and applications of the automatic dust monitor AMIZ-80 is described. Dusts are collected on filter tapes and then measured by low-energy beta radiation absorption. The results are independent on chemical and physical properties of dusts. The dust monitor can be operated automatically in controlled cycles with programmed sampling periods. The nominal range of measured dust concentrations covers 0.01 to 2 mg/m³ divided in six subranges. The accuracy is +- 6% of the full subrange.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 18386

45 EXPLOSIONS AND EXPLOSIVES

19000 **(SAND—84-0112) Microbarograph measurements around the large French blast simulator.** Reed, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1984. Contract AC04-76DP00789. 58p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007820.

Airblast propagations from large shock tubes may cause acoustic insults or possible cosmetic damage to the surrounding environment. Plans for constructing a large shock tube facility, and the associated environmental impact assessment, necessitated a measurement program to verify and refine prediction models based on small shock tubes and various guns. Microbarograph measurements were made at eight locations around a large French blast simulator on five tests. Results were analyzed to yield some modest adjustments to an available British shock tube prediction system. Generally much higher (to 10 dB) airblast overpressures were obtained whan would be expected from extrapolation of various gun test data. The recommended relationship has been used to estimate over pressure isobars around a 163 m² cross-section shock tube, operated at 240 kPa overpressure, with an envelope for possible atmospheric acoustic refractive distortion.

4501 Chemical

REFER ALSO TO CITATION(S) 18077

19001 **(UCID—18574-83-3) H Division Materials Physics. Quarterly report, July-September 1983.** Young, D.A. (ed.). (Lawrence Livermore National Lab., CA (USA)). 24 Feb 1984. Contract W-7405-ENG-48. 71p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84007789.

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H Division has been developing accurate statistical-mechanical models of explosive detonation products which combine molecular physics, accurate liquid theory and multicomponent chemical equilibria. This theory has been applied to the explosive PETN, and good agreement with experiment is obtained for the detonation velocity. Residual discrepancies between theory and experiment suggest that phase separation and chemical kinetics effects are significant. Line emission spectroscopy has proved very useful as a technique for determining the temperature and density of laboratory plasmas. Thorough analysis of these plasmas requires large codes which combine hydrodynamics, radiation transport and atomic physics. Because such codes are very complex and difficult to use, we have instead developed a fast, accurate atomic physics code which synthesizes K-shell spectra at arbitrary temperatures and densities. The code makes use of calculated populations of H-, He-, and Li-like states, then computes lineshapes, and combines these into a synthetic spectrum. The method has been applied to laser-produced and Z-pinch plasmas. The plasma temperatures and densities have been efficiently obtained by fitting the model spectrum to the experimental one. In shockwave experiments on solids it has been traditional to ignore material strength when reducing shock data to a pressure-volume-energy constitutive model. Recent experiments, however, have shown that strength may be non-negligible, even at large shock stresses. We have used these new data to compute the shear stress and thence the true pressure along the shock Hugoniot of beryllium. We find that the pressure is 1.5% below the measured stress in Be at 35 GPa. Further work is needed to determine the importance of this difference for hydrodynamic simulations.

19002 **(UCRL—88760-Rev.1) Simulation of shock-induced energy flux in molecular solids. Revision 1.** Karo, A.M.; Walker, F.E.; DeBoni, T.M.; Hardy, J.R. (Lawrence Livermore National Lab., CA (USA); Nebraska Univ., Lincoln (USA). Behlen Lab. of Physics). 27 Feb 1984. Contract W-7405-ENG-48. 17p. (CONF-830704—9-Rev.1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008331.

From 9. international colloquium on dynamics of explosions and reactive systems; Poitier, France (3 Jul 1983).

Computer molecular dynamics has been used to study the time evolution of the energy of diatomic molecules embedded in a monatomic host lattice when the system is shock loaded. Center-of-mass, rotational, and internal energies were each monitored. For H_2 and CH groups in an iron host, the results demonstrate rapid and violent internal excitation of a totally athermal nature. The origins of this are discussed as are the reasons for the absence of a similar effect for a CH group in a carbon lattice. From these results for diatomic systems it is argued that large molecules, similarly treated, may easily be excited to the point of rupture. If they are so situated (e.g., at or near a surface) that during, or shortly after, excitation they escape from the lattice, they will rupture rather than de-excite and thus generate molecular fragments (e.g., free radicals) which could, in the case of an explosive system, serve to initiate detonation.

4502 Nuclear

REFER ALSO TO CITATION(S) 18988, 19078

19003 **(AD—356270/9) Damage survey and analysis of structures.** Archer, J.S.; Lawlor, E.A. (Massachusetts Inst. of Tech., Cambridge (USA)). Nov 1954. 176p. NTIS, PC A09/MF A01.

The purpose of this study was to determine the damage and blast loading on Operation Greenhouse Army Test Structure 3.1.1 and to survey the damage done to Greenhouse Structure 3.1.3 and other miscellaneous structures. These structures, located on the Eniwetok Atoll, were exposed to the effects of the two atomic bursts (Mike and King) of Operation Ivy in the late fall of 1952. A damage survey was conducted to obtain data upon which to base a correlation of the damage incurred with the measured air-blast overpressures caused by the two shots. The damage caused to Structure 3.1.1 by shot Mike was comparable to that caused by shot Easy of Operation Greenhouse. It is probable that no damage occurred to Structure 3.1.1 from shot King. Only the final permament deflections were recorded of Structure 3.1.1 for shot Mike. The lack of transient response records for this shot increased the difficulty of correlating the loading with the deformations sustained. Analyses were performed on Buildings 2 and 3 of Structure 3.1.1.

19004 **(AD—462397/1) Proof test of AN/TVS-1(XE-3) flash-ranging equipment.** Scarborough, G.D.; Van Sant, J.S. (Army Artillery Board, Fort Sill, OK (USA)). 24 Jan 1961. 16p. NTIS, PC A02/MF A01.

The overall objective of this project was to evaluate the Peerless flash-ranging set, AN/TVS1(XE-3), prior to its acceptance by the United States Army Signal Research and Development Laboratory (ASRDL). The specific objectives were to determine the operational capability of two types of automatic shutter-activating units and to compile data on shutter speeds and filter values at different ranges from point of burst of various low-yield nuclear devices. The project participated in eight detonations at the Nevada Test Site (NTS). Consistent, reliable operation of the equipment

tested was obtained at 18 miles from burst. This distance was the maximum lineof-sight range available for a suitable observation point. Although both types of automatic shutter-activating units performed equally well under conditions of high visibility such as existed during the test participations, the modified version was considered most applicable. Camera settings were kept constant. No recommendation for an overall optimum filtering can be made because samples included only low-yield detonations and cannot be correlated to higher yields, varying ranges, and changing ambient light conditions.

19005 **(AD-A—134795/4) Operation REDWING 1956. Technical report.** Bruce-Henderson, S.; Gladeck, F.R.; Hallowell, J.H.; Martin, E.J.; McMullan, F.W. (Kaman Tempo, Santa Barbara, CA (USA)). 1 Aug 1982. 442p. NTIS, PC A19/MF A01.

REDWING was a 17-detonation atmospheric nuclear weapons test series conducted in the Marshall Islands at Enewetak and Bikini atolls in spring and summer 1956. This is a report of DOD personnel in REDWING with an emphasis on operations and radiological safety.

19006 **(AD-A—134968/7) Special data collection systems. Semiannual report, October 1977-March 1978.** Sherwin, J.R.; Kraus, G.C. (Teledyne Geotech, Garland, TX (USA)). 12 May 1978. 18p. (TR—78-2). NTIS, PC A02/MF A01.

The Special Data Collection System (SDCS) program, Project T/4703, is a continuation of work begun under the Long-Range Seismic Measurements (LRSM) program in 1960. This work is directed toward advancing the seismic detection, identification and location techniques necessary to detect and identify underground nuclear explosions. This report describes the work performed under the SDCS program during the period from October 1977 through March 1978. The basic instrumentation for the SDCS program consists of eleven units of the Portable Seismograph System, Geotech Model 19282. This system includes three-component long-period and three-component short-period seismographs recorded on slow-speed FM magnetic tape, plus necessary calibration, timing, and support equipment. The system is designed for quick deployment and is capable of collecting laboratory quality data using one qualified electronic technician as an operator.

19007 **(AD-A—134990/1) CARS spectroscopy of propellant flames. Final report.** Harris, L.E. (Army Armament Research and Development Command, Dover, NJ (USA). Large Caliber Weapon Systems Lab.). Nov 1983. 38p. (ARLCD-TR—83047). NTIS, PC A03/MF A01.

Broadband coherent anti-stokes Raman scattering (CARS) spectra were obtained from both the reaction zone and postflame regions of CH(4)/N(2)O flames. The temperature and concentration profiles obtained from both N(2) and N(2)O flames were used to understand the elementary processes occurring in CH(2)/N(2) flames. In addition, N(2) and CO vibrational spectra were used to obtain concentration and temperature profiles by a least-square fit to model calculations. The results obtained were in accord with thermochemical calculations. In rich CH(4)/N(2)O flame previously unobserved, CARS spectra were obtained from pure rotational H(2) transitions. These H(2) spectra offer further opportunities for studying propellant systems. The characterization of CARS spectroscopy obtained from these studies was used to obtain initial CARS measurements from the reaction zone of nitramine composite propellant flames. These studies are only possible using a coherent, highly spatially, and temporally resolved spectroscopy such as CARS. These qualities of CARS which have been applied to the deflagration of propellants containing the explosive ingredients nitrocellulose and/or RDX can be used to study the decomposition and explosive reactions of other energetic materials in both the gas and solid phases.

19008 **(AD-A—135042/0) Fuel-air explosive simulation of far-field nuclear airblasts. Final report 9 May 77-31 Dec 79.** Pierce, T.H.; Sedgwick, R.T. (S-Cubed, La Jolla, CA (USA)). 31 Dec 1979. 242p. (SSS-R—80-4366). NTIS, PC A11/MF A01.

Fuel-air explosions (FAE) have been investigated in the context of far-field nuclear airblast simulation. The objective of the investigation is to determine the feasibility of a reusable FAE simulator at the one kiloton level. Two issues have been researched in parallel efforts. These are the mechanisms by which largescale FAE clouds of controlled shape can be reliably and repeatedly formed and detonated, and the quality of nuclear airblast simulation that is achieved when such FAE clouds are detonated. The formation of hemispherical clouds by simultaneous, impulsive liquid fuel injection through a large number of radially directed, centrally clustered nozzles is discussed in detail. Specific fuel dispenser designs are considered and use experience with two of these is described. Survey experiments dealing with the atomization and penetration characteristics of large-diameter, implulsively formed single liquid jets are discussed. Small-scale hemispherical cloud formation experiments are also discussed. A new reusable facility for testing FAE simulation of nuclear airblasts at the 1/4-ton scale is described. Preliminary surface-burst experiments at that scale using propylene oxide and heptane as fuels are discussed. The results from these experiments are scaled and compared with 1 kt nuclear curvefits. The agreement is judged to be reasonable at this scale. Numerical calculations of the airblast that emerges from a detonated heptane-air cloud have also been carried out.

19009 **(AD-A—135043/8) Characterization of the thermal radiation field generated by a one-nozzle torch. Technical report.** Rehmann, W. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Oct 1983. 30p. (ARBRL-TR—02529). NTIS, PC A03/MF A01.

The characteristics of a one-nozzle Thermal Radiation Source were investigated. Liquid oxygen and powdered aluminum were used to produce the radiant torch. Thermal flux and fluence data were mapped at two vertical heights and at horizontal distances that ranged from 25 cm to 90 cm. Thermal pulse shapes associated with three different aluminum injection times were recorded and interpreted in terms of simulated nuclear yields. High-speed photography was used to provide information concerning the flame geometry and dynamics of the source.

19010 **(AD-A—135540/3) Test program for assessing vulnerability of industrial equipment to nuclear air blast. Final report.** Zaccor, J.V.; Selvaduray, G. (Lawrence Livermore National Lab., CA (USA)). Oct 1983. 59p. (UCRL—15558; SSI—8302-8). NTIS, PC A04/MF A01.

The report discusses the design of a test program to develop technical data on the vulnerability of industrial equipment to air blast from nuclear weapons (1 megaton weapons size in the overpressure region up to 20 psi). To achieve the experimental objective, scale models, full size models, and actual equipment may be used for different facets of the program under specific circumstances.

19011 **(AD-A—135658/3) Linear programming, multiple objective approach to nuclear exchange modeling. Master's thesis.** Wambsganss, M.C. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1982. 212p. NTIS, PC A10/MF A01.

This paper describes a linear programming, multiple objective approach to nuclear exchange modeling. Both a weapons allocation model, where weapons are allocated in some optimal fashion subject to a fixed arsenal, and a cost optimization model, where a minimal cost arsenal is determined subject to a specified level of damage, are addressed. Methods are suggested for determining compromise solutions between these two objectives. This paper first describes the range of parameter inputs. Obtainability coefficients are included to add further realism to the model. Also, development costs are considered and modeled via logical constraints. The expressions representing kill probabilities were adopted from other models and are described in detail. This research effort linearizes the damage function by taking advantage of the monotonic characteristics of the logorithmic function. The preference structure is implicitly retained by developing a weighted goal programming formulation, with the weights reflective of the importance of specific target classes. The formulation is applied to a range of strike scenarios and forms a submodel to the cost optimization model.

19012 **(AD-A—135696/3) Getaway: a model for parametric studies in the area of base escape survivability. Master's thesis.** MacGhee, D.F. Jr; Williams, C.P. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1983. 178p. NTIS, PC A09/MF A01.

GETAWAY, a base escape nuclear survivability model specifically designed for parametric studies, is presented. GETAWAY computes the probability of survival for an alert force escaping from a single base under SLBM attack. Parametric studies of 20 escape, threat, and hardness parameters are possible. Nuclear blast, thermal, and prompt radiation intensities are computed and aircraft survivability is derived from cumulative log-normal damage functions of weapon effect intensity. GETAWAY is shown to be an effective alternative to current predictive models for conducting parametric analysis. Its advantages over current base escape survivability models are speed, cost effectiveness, and interactive capabilities while providing parametric results highly comparable to alternative models. GETAWAY's methodology could also be applied to ICBM, naval, or ground force nuclear survivability analyses. A User's Guide, Example Session, and Program Listing are provided as appendices.

19013 **(AD-A—135736/7) Concepts of strategic war: a basis of a new approach to strategic assessment. Final report, 15 October 1978-1 October 1982.** Foster, J.L.; Walker, J.K. (RAND Corp., Santa Monica, CA (USA)). 1 Oct 1982. 100p. NTIS, PC A05/MF A01.

This study seeks to identify both major shortcomings in strategic assessment and those attributes of strategic force postures and employment methods strategic assessment should emphasize. The purpose of strategic forces should evolve from a consideration of acceptable war outcomes rather than from advocacy or from sensitivity to arbitrary scenarios assessments. Contingency and scenario development should follow formulation of the concept of war rather that providing its basis. The theory of victory assumed in the notion of acquisitive war does not necessarily require the decisive defeat of an adversary's military forces and is not contingent on the expectations of a favorable military outcome. Domestic, political, and economic weakness may be fundamental precipitants of war. The war termination problem is one of determining how military means can most effectively and efficiently bring about preferred outcomes. War fighting and war termination strategies must be consistent, but this area of concern has been long neglected and little understood.

19014 **(AD-A—135848/0) Airborne penetration of radioactive clouds. Master's thesis.** Kling, T.R. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1983. 93p. (AFIT/GNE/PH—83M-7). NTIS, PC A05/MF A01.

This report evaluates the threat to aircrew members when their aircraft approaches and subsequently penetrates a descending radioactive cloud generated by a nuclear weapon surface burst. The re-development of Hickman's program consists of a remodeling of the computational methods for sky-shine dose and cloud model. The code also computes the ionizing dose rate an air crew member receives when flying through the radioactive cloud as a function of time. The code computes the doses by considering the cloud size, the aircraft's transit time, the ingestion rate of radioactive particles, the aircraft's distance to the burst, and the aircraft's altitude. A simple extension of the computer code computes the dose received from multiple bursts. The results show that at 9500 meters (about 31,000 feet), the total dose to each aircrew member is about 5 rem after flying through the cloud 1 hour after cloud stabilization. The multiple burst dose is approximately 204 rem under the same conditions as the single burst case. Both the single and multiple burst case use a mission completion time of 8 hours after entering the cloud.

19015 **(AD-A—136031/2) Simulation of a uranium vapor release in the high altitude atmosphere. Memorandum report.** Fedder, J.; Hain, K.; Hyman, E. (Naval Research Lab., Washington, DC (USA)). 22 Nov 1983. 48p. (NRL-MR—5193). NTIS, PC A03/MF A01.

The authors present simulation results for a large uranium gas release in the ionosphere at an altitude of 200 km. The purpose of such an experimental release would be to study infrared emission line strengths and spectra of uranium oxides after a nuclear explosion. The simulation shows that the release would have high ion densities approximately 10 to the 8th power 3/cm, that it would have a radius of about half a kilometer perpendicular to the geomagnetic field, and that it would spread to a few kilometers along the field. They also demonstrate the complete oxidation of U to U02(+) would require tens of seconds.

19016 **(AD-A—136125/2) Response mechanism: blast/fire interactions. Final report.** Kanury, A.M. (Notre Dame Univ., IN (USA). Dept. of Aerospace and Mechanical Engineering). Nov 1983. 90p. NTIS, PC A05/MF A01.

Hypotheses are formulated of the process of interaction between an airblast and fires supported by liquid fuels and wood cribs. A map of blast weakness versus fire strength is conceived on which the regime of fire extinction can be delineated from the regime where the fire sustains the blast. The fire strength is described for liquid fuels primarily by the heat of combustion; and for wood, it is mainly described by the preburn time. The concept is substantiated by the SRI shocktube data.

19017 **(AD-A—995189/8) Operation Hardtack, Phase II. On-site radiological safety support report, Nevada Test Site. Report for 12 Sep-30 Oct 58.** (Reynolds Electrical and Engineering Co., Inc., Mercury, NV (USA). Radiological Safety Div.). 30 Oct 1958. 144p. NTIS, PC A07/MF A01.

19018 **(AD-P—002147/7) Satellite system survivability.** Shelton, F.H. (Kaman Sciences Corp., Colorado Springs, CO (USA)). 1983. 3p. NTIS, PC A02/MF A01.

Present U.S. military capability relies heavily on Earth satellites to maintain connectivity. The essential nature of these satellite systems has made them tempting targets to nuclear attack in wartime. The author reviews U.S. history in high-altitude nuclear device testing and nuclear effects testing on satellites, events in which he directly participated. Physics of the production of nuclear enhanced high-altitude electron belts are reviewed. The author discusses primary effects of the enhanced environment on satellite components. A glimpse into future satellite hardening reveals measures against developing directed energy weapons.

19019 **(ORNL/TM—9005) Integral measurements of neutron and gamma-ray leakage fluxes from the Little Boy replica.** Muckenthaler, F.J. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 23p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007599.

This report presents integral measurements of neutron and gamma-ray leakage fluxes from a critical mockup of the Hiroshima bomb Little Boy at Los Alamos National Laobratory with detector systems developed by Oak Ridge National Laboratory. Bonner ball detectors were used to map the neutron fluxes in the horizontal midplane at various distances from the mockup and for selected polar angles, keeping the source-detector separation constant. Gamma-ray energy deposition measurements were made with thermoluminescent detectors at several locations on the iron shell of the source mockup. The measurements were performed as part of a larger progam to provide benchmark data for testing the methods used to calculate the radiation released from the Little Boy bomb over Hiroshima. 3 references, 10 figures.

19020 **(PB—84-129907) Employment of tactical nuclear weapons: tactical operations, technical considerations and methods of analysis.** Cronholm, G. (Foersvarets Forskningsanstalt, Sundbyberg (Sweden)). Nov 1983. 56p. (FOA-C—20517-A3). NTIS, PC E04/MF E01.

The report constitutes the author's epitome after thirteen years of analysing the concept 'nuclear threat' from a variety of aspects. The main part of the report concerns the possible use of nuclear weapons in tactical and operational contexts. The report contains accounts of nuclear weapons and weapon systems within the army organizations of the two superpowers, tactical modes of employment, i.e. rules and possible regulations for the use of nuclear weapons in ground battle, technical considerations of employment, i.e. rules and routines for carrying out tactical decisions, and meth-

ods of analysis for studying nuclear weapons employment with regard to the requirements of Swedish total Defense authorities.

19021 **(PNL—4392) Radiological assessment of cartridge 120-mm, APFSDS-T, XM829 ammunition.** Hooker, C.D.; Hadlock, D.E.; Soldat, K.L.; Gilchrist, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 40p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007511.

The components of the XM829 round effectively shield out nonpenetrating beta radiation emitted by the depleted uranium; however, photons cna penetrate the components of the round and are therefore the predominant emission. The radiation levels associated with the XM829 ammunition are low. The maximum emissions measured from a cartridge are not likely to result in exposure to military personnel above the maximum permissible nonoccupational dose limits listed in Army Regulation (AR) 40-14. Based upon the specifications contained in 49 CFR 173.424 and the radiation measurement data, the XM829 shipping package may be excepted from the specification packaging, marking and labeling requirements of subpart 49 CFR 173 as long as the outer surface of the uranium is enclosed in an inactive sheath and the conditions specified in 49 CFR 421 (b), (c), and (d) are met.

4503 Explosion Detection

19022 **(PB—84-124056) Deconvolution based on source scaling applied to teleseismic signals.** Israelson, H. (Foersvarets Forskningsanstalt, Sundbyberg (Sweden)). Oct 1983. 46p. (FOA-C—20514-T1). NTIS, PC E04/MF E01.

This report summarizes attempts with deconvolution based on source scaling applied to short period teleseismic signals from presumed underground nuclear explosions. The scaled deconvolution technique, which operates on spectral ratios, separates pairs of recorded signals into source and path records. The technique is tested on recordings at the Swedish Seismic Network from events in Eastern Kazakh. A deconvolution algorithm was applied to selected pairs of events, and gave stable results for one subset of the data. The derived source and path records for such a pair of events were used to compute relative source records to the remaining events. Parameters like rise time and delay of the secondary phase were measured for the relative source records. The measured values scaled in broad agreement with the cube root of equivalent explosion yield.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

19023 **(AD-A—135844/9) Generation, estimation, utilization, availability and compatibility aspects of geodetic and meteorological data.** Luetzow, H.B.v. (Army Engineer Topographic Labs., Fort Belvoir, VA (USA)). Aug 1983. 22p. NTIS, PC A02/MF A01.

Following an introduction, the paper discusses in section 2 the collection or generation of final geodetic data from conventional surveys, satellite observations, satellite altimetry, the Global Positioning System, and moving base gravity gradiometers. Section 3 covers data utilization and accuracy aspects including gravity programmed inertial positioning and subterraneous mass detection. Section 4 addresses the usefulness and limitation of the collocation method of physical geodesy. Section 5 is concerned with the computation of classical climatological data. In section 6, meteorological data assimilation is considered. Section 7 deals with correlated aspects of initial data generation with emphasis on initial wind field determination, parameterized and classical hydrostatic prediction models, non-hydrostatic prediction, computational networks, and computer capacity. The paper concludes that geodetic and meteorological data are expected to become increasingly more diversified and voluminous both regionally and globally, that its general availability will be more or less restricted for some time to come, that its quality and quantity are subject to change, and that meteorological data generation, accuracy and density have to be considered in conjunction with advanced as well as cost-effective numerical weather prediction models and associated computational efforts.

19024 **Parameter study of interactions between convective clouds, the convective boundary layer, and a forested surface.** Garrett, A.J. (Savannah River Lab., Aiken, SC). *Monthly Weather Review;* **110**: No. 8, 1041-1059(Aug 1982).

A numerical model was developed which included cloud parameterizations, a convective boundary layer, solar and longwave radiation, a soil layer and a parameterized forest layer. The model simulated the growth of the convective boundary layer and convective clouds on days when solar heating was primarily responsible for the convection, and mes- or synoptic-scale forcing was weak. The simulations agreed more closely with observations, and were generally more realistic when the parameterized forest layer and interaction between clouds and radiation fluxes were included. Observations and simulations suggest that the model might be able to predict both the onset and general location of regions of cumulonimbus. The simulations also suggest that surface parameters such as soil moisture, forest coverage and transpiration, and surface roughness may affect the formation of convective clouds and rainfall through their effect on boundary-layer growth.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 17979, 18354, 19054, 19060, 19082, 19204

19025 **(DOE/APC—84/1) Acid Precipitation: a current awareness bulletin.** (USDOE Technical Information Center, Oak Ridge, TN). 15 Jan 1984. 9p. (PB—84-901001). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007993.

Research is reported on the cause-effect relationships of the acid precipitation phenomenon. Major emphasis is on man-made sources of suspected precursor pollutant emissions, e.g., sulfur oxides and nitrogen oxides, and on the possible effectiveness of control measures for reducing these emissions. The research is intended primarily to identify and resolve uncertainties with data and models used for decisionmaking on policies and control strategies. The digests in this bulletin and other citations to information on acid precipitation back to 1974 are available on the Energy Data Base (EDB); searching of an retrieval from EDB may be accomplished using either the DOE/RECON system or the Dialog or Orbit commercial on-line retrieval systems. Retrospective searches can be made on any aspect of acid precipitation, or customized profiles can be developed to provide current information for each user's needs.

19026 **(EPRI-EA—3072) Plume model validation and development project: plains site lidar measurements of sulfur dioxide. Final report.** Hawley, J.G.; Fletcher, L.D.; Wallace, G.F.; Prior, C.J.; Sheldon, J.B. (SRI International, Menlo Park, CA (USA)). Dec 1983. 137p. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

Portions are illegible in microfiche products.

The Electric Power Research Institute's Plume Model Validation and Development (PMV & D) Project is designed to provide an extensive set of data on the behavior of power plant plumes emitted from tall stacks. The first phase of this project was conducted at a power plant site on a flat plain in central Illinois. This report describes remote measurements of sulfur dioxide (SO_2) in the plume using a differential absorption lidar (DIAL). The lidar was operated reliably for over 300 hours during intensive measurement periods at 1 to 3 km downwind of the stack. Vertical scanning was used in stable air to document the height and size of the plume. During convective instability, when the plume contacted the surface, the lidar was deployed in a horizontal scanning mode to map the plume footprint. Levels of SO_2 varied from 25 ppb (the detection limit) to several ppM. Examples of data taken under many different atmospheric conditions revealed that the plume is widely variable in the concentration and distribution of its constituents. Data reduction algorithms used to derive the results are described. A comparison test between DIAL and a standard SO_2 analyzer showed DIAL to be accurate and precise. 15 references, 24 figures, 8 tables.

19027 **(EPRI-EA—3075) EPRI Plume Model Validation and Development Project and Experimental Design - Plains Site. Final report.** Bowne, N.E.; Borenstein, H.; Shearer, D.L. (TRC Environmental Consultants, Inc., East Hartford, CT (USA)). Sep 1983. 80p. Electric Power Research Institute, 3412 Hillview Ave, Palo Alto, CA 94304.

The Electric Power Research Institute's Plume Model Validation and Development (PMV & D) Project will provide the data bases and data analyses for operational and diagnostic validation of plume models. Models under consideration are those applied to electric generating facilities. Topographical sites under consideration are: flat and uniform terrain (plains); moderately complex terrain (hilly); and complex terrain (mountainous). Data on plume behavior and ground-level concentrations have been acquired for a Plains Site electric generating station in central Illinois. Measurements were recorded from 200 tracer samplers, 28 air quality monitors, upper air and surface meteorological sensors, 1 airborne and 2 ground-based plume remote-sensing lidars, and 1 in-plume instrumented aircraft. This report provides a historical overview of the PMV & D Plains Site field experiment at the Commonwealth Edison Company's Kincaid generting station. Climatological data from Springfield Airport 25 kilometers north of the station were used in an existing dispersion model to specify sampler locations and measurement periods. Tracer gas was added to the stack effluent and special samplers identified ground level patterns. The lidars provided data on behavior of the plume aloft. 8 references, 15 figures, 5 tables.

19028 **(EPRI-EA—3077) Diagnostic validation of plume models at a plains site. Final report.** Liu, M.K.; Moore, G.E. (Systems Applications, Inc., San Rafael, CA (USA)). Jan 1984. 389p. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

The Plume Model Validation and Development study is intended to validate existing plume models and to provide the scientific basis for future model development. The diagnostic phase of the study consists of an analysis of transport and dispersion processes affecting a plume from an elevated source located above flat terrain. Two important objectives are evaluation of existing plume model components and examination of the relative importance of individual model parameters in determining ground-level concentrations. Extensive ground-level concentrations of an inert tracer and remotely sensed plume cross sections were analyzed graphically by classifying the isopleth concentration patterns. Observations of plume model parameters such as wind speed at stack height, dispersion coefficients, plume rise, and mixing heights were compared with existing plume modules, and algorithms. The bias and precision of algorithm predictions of each model parameter on the ground-level concentration predictions was studied. The data revealed that stability classification schemes provide qualitative and imprecise descriptions of vertical and time variations in atmospheric stability. The existing horizontal dispersion algorithms underpredict the ground-level plume spread observed, but overpredict the plume spread aloft. Both the final plume rise and vertical dispersion coefficient algorithms generally overpredict ground-level concentrations. The sensitivity analysis indicates that ground-level concentrations depend strongly on the interaction between plume rise, vertical dispersion, and temperature inversions. 134 references, 87 figures, 80 tables.

19029 **(EPRI-EA—3292) Comparison of visibility measurement techniques: eastern United States. Final report.** Tombach, I.; Allard, D. (AeroVironment, Inc., Pasadena, CA (USA)). Oct 1983. 165p. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

In a nine-month field study at two sites in Ohio and Pennsylvania, visual range during daylight hours was estimated by a variety of methods. This study was specifically designed to characterize the visibility situation in the eastern United States, and thus focused on methods applicable for visual ranges of less than about 25 km. Data from the study were used to compare various observational methods and to evaluate their suitability for application as operational techniques in the east. The median prevailing visibility at the Ohio site was 16 km (10 mi), and 32 km (20 mi) at the Pennsylvania site. The contrast measurement techniques (telephotometry and photography) correlated best with the human observations when the viewing conditions corresponded to those for which visibility theory is best formulated (black target against a uniform horizon sky), and the target distance was at least half the visual range. The comparison was better when the contrast threshold of the eye was assumed to be about 0.05, rather than the traditional value of 0.02. A systematic bias in telephotometric measurements using targets closer than 5 km severely limited the usefulness of such data; visual range tended to decrease with closeness of target. Except when the relative humidity exceeded 70%, the nephelometric measurements correlated with prevailing visibility almost as well as the contrast measurements, however the average magnitude of the nephelometer visual range differed from the prevailing visibility by a larger factor than did the difference between the contrast measurements and the prevailing visibility. 46 references, 33 figures, 21 tables.

19030 **(Juel—1854) $^{18}O/^{16}O$ ratio in the precipitation at Juelich for the period 1974-1982 and its correlation with meteorological and chemical data.** Foerstel, H.; Huetzen, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie). Jun 1983. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750503.

From 1974 to 1982 precipitation in Juelich were collected during each month. The $^{18}O/^{16}O$-ratio, the pH and the concentration of calcium, chloride and sulfate were determined. The sampling unit did not collect the precipitation alone, but also the dry deposition, too. Correlation studies between all results demonstrate, that the $^{18}O/^{16}O$-ratio of precipitation can be an indicator of air temperature. Wind directions, measured near the ground, cannot be used as a tracer for the movement and dynamic of precipitation. The air temperature, possibly as a stimulator of the heating, is correlated with an increased concentration of calcium and sulfat, and a decrease of the pH. A rise of the sum of precipitation only dilutes the amount of ions deposited. As a general result, important for other applications, the constancy of the $^{18}O/^{16}O$-ratio of precipitation in Juelich has been confirmed for a observation period of eight years.

19031 **(KFK-AFR—007) Analysis of elements in airborne dust.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Arbeitsgemeinschaft zur Foerderung der Radionuklidtechnik). Apr 1983. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750862.

This AFR-Report contains the complete results of program step No. I of the AFR Coordinated Airborne Dust Program (LVPr), with 15 elements of the airborne dust having been measured at comparable conditions at five selected places within the Federal Republic of Germany, whereby different analytical methods were applied. The results are weekly mean values of the element concentrations found for the five collection stations, supplemented by correlation coefficients. The results have been derived from more than 25.000 individual values.

19032 **(LBL—17130) Emissions of volatile organic compounds from architectural materials with indoor applications.** Hodgson, A.T.; Girman, J.R.; Newton, A.S.; Winkes, A. (Lawrence Berkeley Lab., CA (USA)). Sep 1983. Contract AC03-76SF00098. 38p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009385.

The objectives of this study were to identify the major organic compounds emitted by some typical building construction and interior finish materials, quantify emissions of organic solvents from representative adhesives that have indoor applications, and evaluate methods for the rapid screening of architectural materials for organic emissions. Organic compounds emitted by 15 building construction and interior finish materials and by 15 adhesives were identified by gas chromatography/mass spectrometry. A total of 68 major compounds were identified in the vacuum extracts of the construction and interior-finish materials. The lowest molecular-weight compounds among these were phenol, alkyl benzenes, naphthalenes and terpenes. The most frequently occurring compounds were plasticizers. Toleune, styrene and a variety of alkanes were identified in the vacuum extracts of the adhesives. Emission rates of toluene and total alkanes from the adhesives were deter-

mined using a simple exposure apparatus. After 9 to 14 days of drying, three solvent-based adhesives had toluene emission rates ranging from 0.6 to 60 $\mu g\ g^{-1}\ h^{-1}$, and two water-based adhesives, used to glue carpets, had total alkane emission rates of 600 to 800 $\mu g\ g^{-1}\ h^{-1}$. A simple ventilation model, assuming a single, well-mixed chamber, was used to rank the potential indoor air quality impacts of the adhesives.

19033 **(PB—83-239830) Air quality data - 1982 annual statistics including summaries with reference to standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1983. 419p. (EPA—450/4-83-016). NTIS MF A01.

This report represents comprehensive summaries of data produced by the nation's ambient air quality monitoring activities for 1982. The data are summarized in two formats: frequency distributions (Part I) and status of data with references to standards (Part II). These summaries are based on data acquired through extensive monitoring activities conducted by Federal, state, and local pollution control agencies and submitted to the U.S. Environmental Protection Agency's National Aerometric Data Bank. Information is provided on the seven pollutants for which National Ambient Air Quality Standards have been set: total suspended particulates, lead, carbon monoxide, sulfur dioxide, nitrogen dioxide, total hydrocarbons, and ozone. Because the NAAQS for hydrocarbons was revoked on January 5, 1983, total hydrocarbons will be omitted from future publications. Part II does not include a section for hydrocarbon data since the hydrocarbon standard was established as a guide for meeting the ozone standard and monitoring for hydrocarbons is not currently required.

19034 **(PB—84-122837) Sulfur deposition modeling in support of the U.S./Canadian memorandum of intent on acid rain.** Clark, T.L.; Coventry, D.H. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Nov 1983. 134p. (EPA—600/7-83-058). NTIS, PC A07/MF A01.

At the request of the U.S./Canadian Work Group 2 of the Acid Rain Memorandum of Intent, the Eastern North American Model of Air Pollution (ENAMAP-1) was applied to two months of 1978 to simulate the monthly wet and dry depositions and monthly average ambient concentrations of SO2 and sulfate across eastern North America. Using these model results, unit emission (1.0 Tg S/yr) transfer matrices were generated and a model performance study was performed. In addition, a model sensitivity study was conducted to examine the consequences of model input parameter uncertainties.

19035 **(PB—84-127166) Environmental management report, fy 1983.** (Environmental Protection Agency, Philadelphia, PA (USA). Region III). May 1983. 225p. NTIS, PC A10/MF A01.

This report describes the environmental problems found in Region 3, which includes Delaware, Maryland, Pennsylvania, Virginia, West Virginia and the District of Columbia. The most significant Regional problems include hazardous waste dump and disposal sites, the siting of new hazardous waste facilities, ozone and SO2 air pollution, surface water contamination by acid mine drainage and non-point sources, PCB contamination incidents, persistant violations with small water supplies and potential groundwater contamination.

19036 **(PB—84-127208) Introduction to continuous emission monitoring programs. Final report.** Peeler, J.W. (Entropy Environmentalists, Inc., Research Triangle Park, NC (USA)). Jan 1983. 60p. NTIS, PC A04/MF A01.

This document provides a general introduction to continuous emission monitoring for those persons not previously involved in this field. Information is presented on continuous opacity monitoring, as well as instrumental and alternative monitoring techniques for SO2 and NOx (i.e., continuous wet-chemical measurement methods and fuel sampling and analysis methods). This document presents an outline and review of the fundamental concepts, terminology, and procedures used in a continuous emission monitoring program. Also presented are selected technical details necessary to understand the operation of emission monitors, the use of continuous emission monitoring data by air pollution control agencies, and references to other available documents which provide additional information.

19037 **(PB—84-128354) Performance specification tests for pollutant and diluent gas monitors: reporting requirements, report format, and review procedures. Final report.** Oldaker, G.B. III; Peeler, J.W. (Entropy Environmentalists, Inc., Research Triangle Park, NC (USA)). Jan 1983. 118p. NTIS, PC A06/MF A01.

This document presents recommended reporting requirements for performance tests of continuous emission monitoring systems installed at fossil-fuel fired steam generators subject to New Source Performance Standards (NSPS). The recommended reporting requirements are applicable to performance tests conducted according to 40 CFR 60, Appendix B, Performance Specifications 2 and 3 (Promulgated, Federal Register, Vol. 40, No. 194, October 6, 1975). This document details procedures for reviewing such performance tests.

19038 **(PB—84-130418) Relation of urban model performance to stability.** Turner, D.B.; Irwin, J.S. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). 1983. 18p. (EPA—600/D-84-025). NTIS, PC A02/MF A01.

The RAM model performance in estimating SO2 concentrations in St. Louis, MO for 1976 has been discussed in several previous papers by the authors. In these studies the model estimates were compared to the observed concentrations of SO2 at 13 sites in the St. Louis metropolitan area. An analysis is made evaluating the RAM model performance in estimating the infrequently occurring high concentration values. Previous comparisons have been criticized for not assuring that the modeled high concentration values occurred during similar meteorological conditions as when the high concentration values occurred during similar meteorological conditions as when the high concentrations were observed. To address these concerns, the data are sorted by stability class and wind speed before the comparison statistics are computed. This allows a meaningful comparison of average concentrations and high values for each data grouping. Results are displayed graphically and provide insight into the variation of model performance with both stability class and wind speed. The resulting comparisons suggest that the RAM model concentration estimates may have a bias towards underestimating concentrations during very unstable conditions and overestimating concentration values during very stable conditions.

19039 **(PB—84-132695) Occupational exposure to airborne substances harmful to health.** (International Labour Organization, Geneva (Switzerland)). 1980. 51p. NTIS, PC $5.70.

This code, which was adopted at a meeting of experts convened by the ILO with the participation of the World Health Organization, is intended to guide governments, employers and workers in protecting workers' health against the hazards due to the contamination of air at the workplace and in preventing contamination of the working environment. A full glossary defines the terms used in the text.

19040 **(PB—84-133347) Process modifications towards minimization of environmental pollutants in the chemical processing industry.** Tavlarides, L.L. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemical Engineering). Nov 1983. 194p. NTIS, PC A09/MF A01.

The report covers the development of a matrix of significant pollution problems and attendant process modifications which would have impact on the reduction or elimination of pollutants inherent in these processes. Industries covered are: (1) Refining of Nonferrous Metals; (2) The Electroplating Industry; (3) Coal Conversion Processes; (4) Specialty Chemicals; (5) The Paper and Pulp Industry; (6) Iron and Steel Industry; (7) The Primary Aluminum Industry; and (8) Phosphate Fertilizer Industry. The matrix for each of the industries noted covers the individual process; the pollutants and their sources in the process; the nature of the pollutant

and the control strategy for mitigation or reduction of the pollutant.

19041 **(PB—84-137504) Dispersion modelling of sulphur dioxide concentrations in London with reference to the EC Directive limit values.** Spanton, A.M. (Warren Spring Lab., Stevenage (UK)). 1984. 49p. NTIS, PC E04/MF E04.

This report presents the results of a dispersion modelling study of sulphur dioxide concentrations in London forming part of the work carried out by Warren Spring Laboratory on behalf of the Department of the Environment to determine the implications of the EC Directive on air quality limit values for suspended particles (smoke) and SO2. The effect of various controls on the sulphur content of fuel oil and gas oil are investigated using a long-period average Gaussian dispersion model and an emissions inventory for London supplied by the Greater London Council. Sensitivity analyses of changes in several of the parameters used in the model are presented in detail and the calculated concentrations are compared with measured values and shown to be in good agreement. (Copyright (c) Crown Copyright, 1983.)

19042 **(PB—84-140458) Health hazard evaluation report No. HETA 80-186-1149, TLB Plastics Corporation, Marion, Indiana.** Gorman, R.W.; Schleomer, J.R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1982. 25p. NTIS, PC A02/MF A01.

Laboratory analysis of the cellulose acetate propionate heated to the extrusion temperature revealed that emission products included propionic acid, acetic acid, and plasticizers (suspected but not confirmed to be di(2-ethylbutyl)azelate). Recommendations are provided in the body of the full report to further minimize solvent exposure, eliminate exposure to extrusion emissions, and increase worker comfort.

19043 **(PB—84-140664) Health hazard evaluation report No. HETA 81-319-1114, Inmos Corporation, Colorado Springs, Colorado.** Gunter, B. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1982. 26p. NTIS, PC A03/MF A01.

On July 15, 1981, a NIOSH industrial hygienist collected breathing-zone and general room air samples for normal butyl acetate, cellosolve acetate, xylene, and isopropanol, and general room samples for hydrogen fluoride. All samples were either below laboratory detection limits or well within the evaluation criteria established for this report. None of the workers were receiving any exposure. Noise measurements were taken on twelve workers in the Clean Room. Their exposures averaged less than 80 dBA. At no time during the work cycle was the evaluation criterion of 85 dBA exceeded. None of the workers had work associated health complaints. NIOSH investigators concluded that a health hazard did not exist at the time of this survey.

19044 **(PB—84-141860) Health hazard evaluation report No. HETA 81-432-1105, roofing sites, Rochester and Buffalo, New York.** Tharr, D.G. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1982. 16p. NTIS, PC A02/MF A01.

On August 12, 1981, NIOSH was requested to evaluate the tear-off operation of old coal tar pitch roofs and the application of a single-ply roofing system. NIOSH considers coal tar pitch a carcinogen and this environmental limit should be regarded as the upper limit of exposure and conditions should be made to keep exposure as low as possible. Workers reported experiencing phototoxic effects including skin erythema, photophobia and conjunctivitis. Although limited sampling was conducted during this study, the results suggest exposure to cyclohexane solubles and PNAs during tear-off procedures are as high or greater than levels to which workers are exposed during application of new roofs using hot asphalt or pitch.

19045 **(UCID—20017) Critical look at Idso's experiments.** Luther, F.M. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007797.

Dr. Sherwood Idso has analyzed data from three empirical experiments in an effort to determine the climatic sensitivity to changes in radiative forcing. Idso characterizes the climatic sensitivity by defining a surface air temperature response function, which is the change in equilibrium surface air temperature divided by the initial change in net radiative fluxes at the earth's surface resulting from some perturbation. He suggests that these experiments indicate that the climatic response to doubled CO_2 concentration will be about an order of magnitude less than that derived from simulations with numerical models. This report takes a critical look at the experiments that are central to Idso's propositions. Although there are still important uncertainties concerning model results, much of the disagreement is traced to errors in Idso's approach and inappropriate application of his experimental data to interpretation of the sensitivity of the global climate to a doubling of CO_2. 8 references.

19046 **(UCID—20018) Chronology of the controversy between S.B. Idso and climate modelers.** MacCracken, M.C.; Luther, F.M. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009128.

Estimates from an extensive series of model calculations over the last twenty-five years have suggested that a doubling of CO_2 concentrations would lead to a warming of global average surface air temperatures of a few degrees Celsius. Except for outliers explainable in terms of overly simplified model assumptions, very few of the many model calculations lie outside this range. In a series of articles and letters that have been published since 1980, S.B. Idso argues that he has found an empirical approach that indicates that models have overestimated the climate's sensitivity by about a factor of ten. This paper reviews the various arguments put forth by Idso and the responses and critiques prompted by them on the part of climate modelers. 35 references. (ACR)

19047 **Chemiluminescent detection of reduced sulfur compounds with ozone.** Kelly, T.J.; Gaffney, J.S.; Phillips, M.F.; Tanner, R.L. (Brookhaven National Lab., Upton, NY). *Analytical Chemistry;* **55**: No. 1, 135-138(Jan 1983). Contract AC02-76CH00016.

With the aim of developing a simple, sensitive, selective real-time method for measurement of reduced sulfur gases, we have investigated the chemiluminescent detection of H_2S, DMS, and other reduced sulfur compounds by their oxidation with ozone. The observation of chemiluminescence in the 300 to 400 nm wavelength region resulting from the gas-phase reaction of O_3 with H_2S, DMS, and methyl mercaptan (C-H_3SH) has been identified as electronically excited SO_2. The homogeneous gas-phase reaction of ozone with hydrogen sulfide has been reported to be slow in studies at low pressures and the oxidation mechanism is apparently complex. A reaction order for H_2S from 0.5 to 2 has been observed, and a heterogeneous reaction pathway has been proposed as a possible explanation of the data. Reported here are results of a preliminary investigation of the ozone-reduced sulfur chemiluminescence, which also imply a complex reaction mechanism (possibly both homogeneous and heterogeneous) but indicate that ozone chemiluminescence may be an extremely useful tool for the detection of H_2S, DMS, and other reduced sulfur species in the ambient atmosphere and in industrial applications.

19048 **Mitigation of acid rain - policy alternatives.** Knudson, D.A.; Streets, D.G. (Argonne National Lab., IL). *Environmental Progress;* **1**: No. 2, 146-153(May 1982).

The paper addresses what may well prove to be one of the most sensitive environmental issues of the 1980's: mitigation of acid-rain impacts. The emphasis is not on the need for such measures nor the benefits that might be gained, but rather on the relative effects of a number of different policy options that could be invoked. The relative advantages and disadvantages of alternative strategies for the reduction of sulfur-dioxide emissions from coal-fired electric generating stations are described. 3 references, 5 figures, 3 tables.

19049 Evaluation of a modified CEA Instruments, Inc. Model 555 analyzer for the monitoring of formaldehyde vapor in domestic environments. Matthews, T.G. (Oak Ridge National Lab., TN). *American Industrial Hygiene Association Journal;* **43**: No. 8, 547-552(1982). Contract W-7405-ENG-26.

Modifications have been made to the experimental design, chemical reagents, and operational protocol for a CEA Instruments Model 555 analyzer to optimize the performance of the instrument for formaldehyde (CH_2O) monitoring. The improved sensitivity and reliability of the modified instrument enhances its suitability for quasi-real-time monitoring of domestic environments with low CH_2O concentration levels (0.01-0.2 ppM). Calibration data taken at sub-0.1 ppM CH_2O levels yields a detection limit of ~ 0.01 ppM. The CH_2O response of the instrument is insensitive to changes in humidity, but demonstrates a serios temperature dependence between 16 and 38°C. Calibration data taken at room temperature, is, however, applicable between 16 and 28°C if a specific operational protocol is observed. Field results taken in 3 dwellings with low CH_2O concentration levels are reported. The performance of the modified CEA Instrument compared favorably with an environmentally controlled, reference, air-sampling unit.

19050 Low-infiltration housing in Rochester, New York: a study of air-exchange rates and indoor air quality. Offermann, F.J. (Univ. of California, Berkeley); Hollowell, C.D.; Nazaroff, W.W.; Roseme, G.D.; Rizzuto, J.R. *Environment International;* **8**: 435-445(1982). Contract AC03-76SF00098.

A sample of 58 occupied homes in Rochester, NY, most of which incorporated special builder-designed weatherization components, were studied to assess (1) the effectiveness of construction techniques designed to reduce air leakage; (2) the indoor air quality and air-exchange rates in selected airtight houses, and (3) the impact on indoor air quality of mechanical ventiliation systems employing air-to-air heat exchangers. The "specific leakage area" was measured in each house using the fan pressurization technique. Houses built with polyethylene vapor barriers and joint-sealing were as a group 50% tighter than a similar group of houses without such components. Mechanical ventilation systems with air-to-air heat exchagers were installed in nine relatively airtight houses, some of which had gas stoves and/or tobacco smoking occupants. Air-exchange rates and indoor concentration of randon (Rn), formaldehyde (HCHO), nitrogen dioxide (NO_2), and humidity were measured in each house for 1-week periods with and without mechanical ventilation. More detailed measurements, including concentrations of carbon monoxide and inhalable particulates, were made in two of these houses by a mobile laboratory. In all nine houses, air-exchage rates were relatively low (0.2-0.5 ach) without mechanical ventilation, and yet indoor concentrations of Rn, HCHO, and NO_2 were below existing guidelines. Mechanical ventilation systems were effective in further reducing indoor contaminant concentrations. We conclude that when contaminant source strengths are low, acceptable indoor air quality can be compatible with low air-exchange rates.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 18180, 18253, 18259, 18260, 19014, 19068

19051 (CONF-840202—17) PREPAR: a user-friendly preprocessor to create AIRDOS-EPA input data sets. Sjoreen, A.L.; Miller, C.W.; Nelson, C.B. (Oak Ridge National Lab., TN (USA); Environmental Protection Agency, Washington, DC (USA)). 1984. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007557.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

PREPAR is a FORTRAN program designed to simplify the preparation of input for the AIRDOS-EPA computer code. PREPAR was designed to provide a method for data entry that is both logical and flexible. It also provides default values for all variables, so the user needs only to enter those data for which the defaults should be changed. Data are entered either unformatted or via a user-selected format. A separate file of the nuclide-specific data needed by AIRDOS-EPA is read by PREPAR. Two utility programs, EXTRAC and RADLST, were written to create and list this file. PREPAR writes the file needed to run AIRDOS-EPA and writes a listing of that file.

19052 (DOE/ER/60186—1) Study of the atmospheric chemistry of ^{218}Po. Progress report, August 21, 1983-March 14, 1984. Hopke, P.K. (Illinois Univ., Urbana (USA). Inst. for Environmental Studies). Mar 1984. Contract AC02-83ER60186. 24p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009145.

Studies have been completed that have demonstrated that there are two mechanisms for the neutralization of $^{218}Po^+$ ions formed by the decay of ^{222}Rn. In the presence of oxygen, an oxide species is formed. It has been determined as part of the present work that this oxide species has an ionization potential in the range of 10.35 to 10.53 eV and that it can be neutralized by extracting electrons from lower ionization potential trace gases. It has also been found that a second mechanism is responsible for neutralization in the absence of oxygen. The behavior of NO_2 in the range of 50 ppB to 1 ppM in N_2 was explored. For NO_2 concentrations above 700 ppB, complete neutralization was observed. For lower concentrations, a concentration dependent degree of neutralization was observed. Studies are now being initiated to examine the kinetics of these neutralization processes. 27 references, 3 figures, 4 tables.

19053 (DP—1668) Computer code for the estimation of pollutant concentrations on or near buildings. Smith, F.G. III; Weber, A.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Nov 1983. Contract AC09-76SR00001. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007800.

Portions are illegible in microfiche products.

A computer code has been developed for the calculation of pollutant concentrations from sources located on or near buildings. This report provides the basis for the model development and a user's guide to the computer code. The code is operating on the WIND System computer at the Savannah River Laboratory and is named VENTX.

19054 (KAERI/RR—351/82) Estimation of atmospheric diffusion factor for the safety analysis of reactor facilities. Rho, C.S.; Rho, B.W.; Lee, Y.B.; Kim, B.W. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 40p. (In Korean). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700092.

The purpose of the present study is to develop the computer code for the determination of atmospheric diffusion factors relevant to gaseous radioactive effluents and to furnish the results readily applicable to the regulatory purposes of nuclear safety. Various meteorological data from the Kori site for the period of Janurary 1975-February 1982 were processed for ready use. For the estimation of diffusion factor in the case of accident, 2.5 percentile of the normal distribution is assumed and it has turned out to correspond to that for the period of 8-24 hours after the occurrence of accident in US NRC Regulatory Guide 1.4 and it suggests a new direction of our own guide for accidents which should be established in the near future in Korea.

19055 (NIRS-M—35) Latest topics of radioiodine released to the environment. (National Inst. of Radiological Sciences, Chiba (Japan)). 1979. 190p. (CONF-7911194—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780136.

From 7. NIRS seminar on enrivonmental research; Anagawa, Chiba, Japan (12 Jan 1997).

Individual papers are indexed for the data bases.

19056 (Y/DK—362) AIRFIL: a FORTRAN program for reduction of data obtained from alpha spectrometry of perimeter air filters. Hinton, E.R. Jr.; Howell, R.L. (Oak Ridge Y-12 Plant, TN (USA)). Mar 1984. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008239.

Isotopic alpha spectrometry of ^{238}U, ^{235}U, and ^{234}U, along with gross alpha/beta counting of perimeter air filters, is performed by the Oak Ridge Y-12 Plant Laboratory in support of the Envrirnomental Monitoring Section of the Radiation Safety Department. Weekly samples are gross alpha/beta counted and the isotopic analysis performed on quarterly composites. Calculations and data management represents a major portion of the anlaysis time when performed manually, even with a desktop calculator. In order to reduce calculation time, perform orderly data manipulation and management, reduce errors due to redundant calculations, and eliminate report typing turnaround time, a computer program (AIRFIL) has been developed that performs these functions. The program accepts data through user prompts, then calculates and prints intermediate and final data, including detection limits.

5004 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 17941

5006 Regulations

REFER ALSO TO CITATION(S) 19033, 19041

19057 **(EPA—450/3-84-004) Benzene emissions from benzene storage tanks - background information for proposal to withdraw proposed standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1984. 103p. NTIS, PC A06/MF A01.

Portions are illegible in microfiche products.

On December 19, 1980, the US Environmental Protection Agency (EPA) proposed National Emissions Standards for Hazardous Air Pollutants (NESHAP) for benzene storage vessels under the authority of Section 112 of the Clean Air Act. The proposed standards were published in the Federal Register (45 FR 83952) with a request for public comment. A public hearing was held on June 9, 1981. Six individuals representing three organizations made presentations. A total of 22 comments from industry, two trade associations, and an environmental group were submitted during the comment period. Comments submitted relevant to the withdrawal decision and EPA's responses are summarized in this document. The summary of comments and responses serves as the basis for the proposal to withdraw the proposed standards.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 19082

19058 **(DOE/SR/00870—34) Comparison of sludge and fertilizer applications on establishment and growth of seedlings of two sweetgum ecotypes endomycorrhizal with glomus mosseae and glomus etunicatus. Progress report.** Kormanik, P.P. (Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development). Nov 1983. Contract AI09-76SR00870. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007867.

A study of sludge and fertilizer applications on the development of sweetgum progeny from two different mother trees. There are significant differences in survival between the genetically different half-sib progeny. Half-sib progeny from mother tree 76-11 had 72% survival, while those from 76-9 had only 56% survival. A second study had only one level of a commercial fertilizer which was used for all genetic tree lines. The third outplanting experiment was installed to compare root coolar diameters of progeny from two genotypic lines of sweetgum.

19059 **(PNL-SA—11806) Elk of the arid lands ecology reserve: a preliminary status report.** McCorquodale, S.M. (Washington Univ., Seattle (USA). Coll. of Forest Resources). Nov 1983. Contract AC06-76RL01830. 15p. (CONF-831269—2). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006661.

From Annual meeting of the Washington State Wildlife Society; Richland, WA, USA (7 Dec 1983).

The status of a group of elk inhabiting the shrub-steppe of eastern Washington is reported upon. Radio telemetry was used to locate groups of elk, and group composition was noted when possible. Observations indicated 25 elk inhabited the reserve at the beginning of the study (3 adult males, 2 yearling males, 6 calves, and 14 adult females). During the second year, the population numbered 38 animals (5 adult males, 3 yearling males, 13 calves, and 17 adult females). The growth in the population was due solely to reproduction. 10 references, 2 figures, 2 tables.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 17988, 18253, 19040, 19069, 19094, 19095

19060 **(CONF-840269—5) Areas with forest soils sensitive to acid deposition, given alternative damage hypotheses.** Turner, R.S. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007602.

From NADAP Task Group G peer review meeting; Burlington, VT, USA (14 Feb 1984).

This project reviews the potential for forest soil changes caused by acid deposition and examines hypothesized roles of these soil changes in damage to trees. By mapping, for each set of hypotheses, the areal extent of those soils that could change from a nondamaging to a potentially damaging chemical state, a bound or limit to the locations where soil mediated forest damages could occur can be determined. This project integrates the results of research on processes of soil chemistry modification by acid deposition and research on causes of tree growth reduction and mortality. The maps produced will be input directly to the 1985 Assessment of Forest Resources.

19061 **(LA—10011-PR) Subsurface transport of contaminants from energy process waste leachates. Progress report, January 1-December 31, 1982.** Wangen, L.E.; Stallings, E.A. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008372.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

Progress during calendar year 1982 on research into the processes and mechanisms controlling the aqueous movement of inorganic solutes through soils and predominant soil mineral components is described. The research is designed to develop capabilities for predicting the transport of inorganic and organic solutes through subsurface geologic materials, and is coordinated with research at three other institutions. Los Alamos is studying solute movement using mainly laboratory column methods designed to simulate one-dimensional transport through porous media. Trace elements being studied are As, B, Cd, Mo, Ni, and Se. Matrix species include Ca, K, NO_3^-, and SO_4^{2-}. Presently, 0.01M $KClO_4$ is being used as an ionic strength buffer. Solids adsorbents being or to be studied are geothite, kaolinite, illite, montmorillonite, in addition to soils collected in the field. Presented in this report are soil and soil mineral components to be used in the experimental program, the chemical and physical properties determined for some of the adsorbents being used, results of studies into the speciation of selenium in influent and effluent from previously completed soil column experiments, and results of column transport experiments for selected inorganic elements (As, B, Cd, Mo, Ni, and Se) in a calcareous soil and the mineral goethite (α-FeOOH). 3 references, 5 figures, 5 tables.

19062 **(PB—84-123694) Three new techniques for floating pollutant spill control and recovery. Final report, 15 September 1978-14 September 1979.** Bannister, W.W.; Donatelli, A.H.; Curby, W.A.; Kan, D.L.; Dalton, W.J. (Lowell Univ., MA (USA)). Nov 1983. 157p. NTIS, PC A08/MF A01.

Hazardous material (HM) spills pose serious problems in terms of the very poor visibility often attending such situations. No operational capability exists at night or other periods of low visibility. However, time is very important in spill control and recovery work; in a few hours, areas cleared of an HM spill can be covered again as unharvested HM drifts back over the cleared track. This report discusses new techniques whereby (1) HM spills can be gelled quickly and completely to a solid consistency. The gel is of much greater visibility; does not readily flow or spread; is easily, quickly, and completely recovered by nets; has lower volatility and lower fire and toxicity hazards; does not permeate into porous materials; and is easily regenerated into the original HM and gelling components. (2) Cheap, nontoxic and efficient fluorescent agents can be applied in low (50-ppm) concentrations onto spills by conventional crop-dusting or spraying techniques. Where there is open water with no HM cover, the fluorescer is dissipated into the water, but is preferentially retained wherever there are HM patches. At night, illumination by UV light (modified mercury vapor street lights) can be beamed over the spill area. Vivid fluorescent illumination occurs only from the HM patches, providing nighttime control and recovery capability. (3) Underwater sonic sensing provides excellent synergistic effects with the fluorescence technique.

19063 **(PB—84-124999) EPA-ORD (Environmental Protection Agency's Office of Research and Development) mobile incineration system trial burn.** Yezzi, J.J. Jr; Brugger, J.E.; Wilder, I.; Freestone, F.; Miller, R.A. (Environmental Protection Agency, Cincinnati, OH (USA). Municipal Environmental Research Lab.). Jan 1984. 26p. (EPA—600/D-84-004). NTIS, PC A03/MF A01.

This paper discusses testing of the EPA Mobile Incineration system developed through the Office of Research and Development for the purpose of destroying hazardous materials on site. The test program (Trial Burn) consisted of a series of five tests that were designed to evaluate the system's ability to destroy selected hazardous organic materials and to control emissions of HCl, particulate matter, and organics in accordance with the requirements of the TSCA, RCRA, and the New Jersey State Department of Environmental Protection. Discussed herein are: (1) the trial burn plan including the sampling and analytical program, (2) the results of the tests, and (3) the impact of the test program on the local environment. The function of the Mobile Incineration System is to demonstrate the ability of on-site thermal destruction of hazardous materials at remote spill or disposal sites. Since treatment of hazardous materials is controlled by state and federal regulations, a Trial Burn Plan was developed to comply with these regulations and establish the performance capability of the system in destroying/destoxifying hazardous and toxic substances.

19064 **(PB—84-126473) Continuous respirable dust monitoring system (crdms). Open file report 29 August 1980-31 December 1982.** Lilienfeld, P.; Stern, R.; Tiani, G. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). May 1983. 103p. NTIS, PC A06/MF A01.

The objective of this program was the development, design, fabrication, and laboratory testing of a mine-worthy continuous respirable dust monitoring system (CRDMS). The operation of the sensor unit of the system is based on the light scattering intensity of the respirable fraction of airborne dust. The CRDMS is compatible with the typical environmental rigors that characterize coal mines and, in particular, the shock, vibration, impact, moisture, and dust conditions prevailing at active mining machines. The sampled area must be within the breathing zone of the mining machine operator, whose dust exposure is to be monitored by the CRDMS sensor unit. Instantaneous, as well as shift-averaged dust concentrations, are displayed and recorded for later retrieval. Alarm indications and other diagnostic information are provided.

19065 **(PB—84-126929) Characterization of hazardous waste sites-a methods manual: Volume 2. Available sampling methods. Response report.** Ford, P.E.; Turina, P.J.; Seely, D.E. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Sep 1983. 229p. (EPA—600/4-83-040). NTIS, PC A11/MF A01.

Investigations at hazardous waste and environment-threatening spill sites inevitably require that on-site measurements and sampling activities be conducted in order to assess the type and extent of contamination present. Due to the nature of sites and materials under investigation, however, not all sampling and measurement procedures may be applicable. It is important, therefore, that personnel involved in hazardous waste investigations be aware of the sampling procedures and measurement techniques most suited to their needs. This document is dedicated to sampling procedures and information, its purpose being to present a compilation of methods and materials suitable to address most needs that arise during routine waste site and hazardous spill investigations. It is part of a multivolume manual entitled, Characterization of Hazardous Waste Sites - A Methods Manual, developed by the U.S. Environmental Protection Agency to serve a wide variety of users as a source of information, methods, materials and references on the subject.

19066 **(PB—84-135789) Investigation of soil and water contamination at Western Processing, Inc., King Co., Washington. Part 1. Report for September-November 1982.** (Environmental Protection Agency, Seattle, WA (USA)). May 1983. 91p. (EPA—910/9-83/104A). NTIS, PC A05/MF A01.

Western Processing, Inc., Kent, Washington, which operated as an industrial waste recycling facility, was suspected of having contaminated soil, groundwater and surface water on and around its 13-acre site. After intensive sampling and analysis, significant levels of many toxic substances were identified in a high proportion of the soil and groundwater samples; these included 21 known carcinogens and 28 suspected carcinogens. At least 19 of the soil samples and six of the groundwater samples were defined as hazardous waste by the standards of the Resource Conservation and Recovery Act (RCRA) by reason of their content of soluble toxic metal.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 18180, 18236, 18237, 18240, 18250, 18253, 18263, 18874, 19040, 19051, 19055, 19094, 19108, 19111, 19115, 19115, 19174, 19177, 19178

19067 **(CONF-840202—19) Application of computers in a Radiological Survey Program.** Berven, B.A.; Blair, M.S.; Doane, R.W.; Little, C.A.; Perdue, P.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007519.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

A brief description of some of the applications of computers in a radiological survey program is presented. It has been our experience that computers and computer software have allowed our staff personnel to more productively use their time by using computers to perform the mechanical acquisition, analyses, and storage of data. It is hoped that other organizations may similarly profit from this experience. This effort will ultimately minimize errors and reduce program costs.

19068 **(CONF-840202—20) FOODCHAIN: a Monte Carlo model to estimate individual exposure to airborne pollutants via the foodchain pathway.** Dixon, E.; Holton, G.A. (Oak Ridge National Lab., TN (USA); Maxima Corp., Oak Ridge, TN (USA)). 1984. Contract W-7405-ENG-26. 8p. NTIS, PC A02; 3; GPO Dep. Order Number DE84007917.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

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Ingestion of contaminated food due to the airborne release of radionuclides or chemical pollutants is a particularly difficult

human exposure pathway to quantify. There are a number of important physical and biological processes such as atmospheric deposition and plant uptake to consider. These processes are approximate by techniques encoded in the computer program TEREX. Once estimates of pollutant concentrations are made, the problem can be reduced to computing exposure from ingestion of the food. Some assessments do not account for where the contaminated food is eaten, while others limit consumption to meat and vegetables produced within the affected area. While those approaches lead to an upper bound of exposure, a more realistic assumption is that if locally produced food is not sufficient to meet the dietary needs of the local populace, then uncontaminated food will be imported. This is the approach taken by the computer model FOODCHAIN. Exposures via ingestion of six basic types of food are modeled: beef, milk, grains, leafy vegetables, exposed produce (edible parts are exposed to atmospheric deposition), and protected produce (edible parts are protected from atmospheric deposition). Intake requirements for these six foods are based on a standard diet. Using TEREX-produced site-specific crop production values and food contamination values, FOODCHAIN randomly samples pollutant concentrations in each of the six foodstuffs in an inerative manner. Consumption of a particular food is weighted by a factor proportional to the total production of that food within the area studied. The exposures due to consumption of each of the six foodstuffs are summed to produce the total exposure for each randomly calculated diet.

19069 **(DOE/EV/00641—49) Mineral cycling in soil and litter arthropod food chains. Three-year progress report, November 1, 1980-January 31, 1984.** Crossley, D.A. Jr. (Georgia Univ., Athens (USA). Dept. of Entomology). 1984. Contract AS09-76EV00641. 78p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84001775.

This report summarizes our analysis of trophic dynamics in soil fauna including their impact on the decomposition process, investigation of relationships between soil fauna and microflora, development and testing of models describing these processes, and documentation of rates of movement of nutrients along soil arthropod food chains.

19070 **(GSF-S—861) Foliar uptake of radioisotopes and its consequences for the contamination of agricultural products.** Proehl, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Jul 1982. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750729.

The contamination of nutritional parts of plants via radionuclides taken up through the leaves depends on the mobility of the radionuclides in the plant. The alkaline metals, iodine and technetium for example, are considered as mobile; due to the migration in the interior of the plant, these nuclides cause the highest food contamination after foliar uptake of radionuclides. The alkaline earth metals, cerium, ruthenium and plutonium are considered as immobile; the contamination by these elements is almost exclusively induced by direct nuclide deposition on the nutritional parts of the plants. Cobalt, zinc, manganese and iron have a certain middle position with regard to radionuclide migration. Gaseous iodine is taken up through slit-like apertures. The uptake may be very effective; under humid conditions the uptake is higher than under arid conditions. Due to the short half-time period only the meadow-cow-milk-path is relevant for the exposure to iodine 131, for other paths however, the longeval iodine 129 is important. The development of the specific activity of meadow grass after one single deposition can be described with a massdependent interceptory factor and two subsequent meteorologic half-times of 14 and 28 d. Model estimations show that after nuclear disorders in the middle of the year for some radionuclides and important nutritients the human activity supply via foliar uptake will exceed the activity supply via soil - root migration by up to 2 magnitudes during the next 50 years.

19071 **(GSF-S—882) Simulation of radionuclide transfer in agricultural food chains.** Matthies, M.; Eisfeld, K.; Mueller, H.; Paretzke, H.G.; Proehl, G.; Wirth, E. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Dec 1982. 192p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84750738.

Radioactive releases from nuclear facilities could pose long-term potential hazards to man if radionuclides enter food chains leading to man. The aim of the study was to develop radioecological and dosimetric models for the assessments of the activity intake by man via ingestion and the resulting radiation exposure for members of the population, in particular after accidental releases from fuel reprocessing plants and related installations. A dynamic compartment model for the transfer of radionuclides through agricultural food chains has been developed. Special emphasis is given to the time dependence and the biological and site specific variability of the various transfer and accumulation processes. Agricultural practices representative for Western Europe have been taken into consideration for food production (grain, potatoes, vegetables, beef and pork, milk). For the most relevant long-lived radionuclides a short-term initial deposition of 1 Ci/km^2 on agricultural areas at different months has been assumed and the time dependent transport through various food chains has been assessed. As a main result great differences have been calculated for the various months of releases because of plant foliar uptake and translocation into edible parts of the plants during the vegetation cycle. The potential activity intake over 50 years for the various nuclides and the resulting radiation exposure is dominated by the first two years after the release if no food restrictions are assumed.

19072 **(GSF-S—940) Radionuclides in soil and vegetation around a coal-fired power plant.** Bunzl, K.; Chatterjee, B.; Hoetzl, H.; Lapointe, M.C.; Rosner, G.; Winkler, R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). May 1983. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750746.

Pb-210, Po-210, Ra-226, U-238, Th-232 and K-40 were determined in 95 soil samples around a black coal-fired power plant (254 MW). Besides, these radionuclides were also measured in the fly ash (last stage of the electrostatic precipitator) as well as Pb-210 and Po-210 in several samples of the vegetation. For the determination of Pb-210 and Po-210 methods for the dissolution of relatively large (10 g) soil samples and for the radiochemical separation were developed. The local distribution patterns of the specific activities of Pb-210, Po-210 and Ra-226 in the soils around the power plant as well as the ratios of these nuclides in the soil and in the fly ash do not reveal any noticable effects of the power plant emissions on the natural concentration of these radionuclides in these soils. The observed specific activities of the radionuclides in the fly ash are obviously too small to cause a perturbation of these nuclides in the soil which exceeds the natural variations. The specific activities of Pb-210 and Po-210 in the vegetation samples confirm this conclusion. As a result of the special distribution of the soil types in this area (significantly different concentrations of stable potassium in the soils of the valley and along the slopes of the hills) a nearly bimodal frequency distribution was observed for K-40 and Th-232 in the soils. Also a highly significant correlation was found between K-40 and Th-232 in the soil.

19073 **(NIRS-RSD—49) Radioactivity survey data in Japan.** (National Inst. of Radiological Sciences, Chiba (Japan)). Jun 1979. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780141.

Individual papers are included in the data bases.

19074 **(NIRS-RSD—52) Radioactivity survey data in Japan.** (National Inst. of Radiological Sciences, Chiba (Japan)). Mar 1980. 58p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780142.

Individual papers are included in the data base.

19075 (NUREG/CR—3512) Rapid field method for the concentration of radioiodine from milk. Solbrig, R.M.; Huchton, R.L.; Motes, B.G. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Oct 1983. Contract AC07-76ID01570. 25p. (ENICO—1137). NTIS, PC A02/MF A01 - GPO; GPO Dep. Order Number DE84007352.

The development and testing of a practical field method for the collection of radioiodine from milk is reported. The technique is simple, rapid and relatively inexpensive to perform and yields a good iodine collection efficiency. The batch method involves adding a 250-ml volume of Dowex 1-X8 anion exchange resin to 3.5 liters of milk, mixing at a rate of 30 rotations per minute for three minutes, separating the resin and milk by pouring the mixture through a wire-screened canister, and rinsing the resin with 200-ml of distilled water. Advantages of the procedure include: minimal equipment and personnel training; an inexpensive industrial-grade resin; a total of ten minutes to complete; and an adaptability of the wire-screened canister to different geometries for direct counting. Additionally, the total collection efficiency of 81 +- 6% is relatively independent of temperature, iodide concentration, mixing rate and mixing time.

19076 (NVO—273) Long-term hydrologic monitoring program. Rulison Event Site, Grand Valley, Colorado. (USDOE Nevada Operations Office, Las Vegas). Jan 1984. 29p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008210.

The Hydrologic Program Advisory Group reviewed the Long-Term Hydrologic Monitoring Program proposed for the Rulison site at their December 12, 1971, meeting. Samples are collected annually, at about the same dates each year. The hydraulic head, temperature in °C, pH, and electrical conductance are recorded at the time of sample collection. Prior to October 1, 1979, each sample was analyzed for gamma emitters and tritium. Gross alpha and beta radioactivity measurements were made on all samples collected. After October 1, 1979, these analyses were discontinued in favor of high-resolution gamma spectrometry using a GeLi detector. For each sample location, samples of raw water and filtered and acidified watar are collected. The raw water samples are analyzed for tritium by the conventional method. Those samples with concentrations that are below the detection level for this method are then analyzed by the enrichment method. Portions of the filtered and acidified samples are analyzed for gamma emitters.

19077 (PNL-SA—10885) Meaning of radiation for those atolls in the northern part of the Marshall Islands that were surveyed in 1978. Bair, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 72p. (In English and Marshallese). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008308.

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This book explains the results of the 1978 radiation measurements for the following atolls: Rongelap, Utrik, Taka, Bikar, Rongrik, Ailinginae, Likiep, Ailuk, Jemo, Mejit, Wotho and Ujelang. It explains the meaning of radiation, and about the radioactive particles that came from the atomic bombs, and about their distribution in the soil of each of these atolls. The book also gives information about the amounts of radiation people might receive now and later from radioactivity remaining on the atolls. (ACR)

19078 (PNL-SA—11548) Decontamination analysis of a radiologically contaminated site. Tawil, J.J.; Strenge, D.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 21p. (CONF-840202—24). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008321.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

This paper presents an analysis of decontamination options at the NUWAZX-83 exercise site. Held in May 1983, the purpose of the exercise was to evaluate the ability of federal, state and local officials to respond to a radiological accident involving nuclear weapons. A computer program developed by Pacific Northwest Laboratory was used to conduct the decontamination analysis. The program, called DECON, was designed to assist personnel engaged in the planning of decontamination activities. The many features of DECON that are demonstrated in this paper contribute to its potential usefulness as a planning tool for site restoration. Strategies that are analyzed with DECON include: (1) using a Quick-Vac option, under which exterior surfaces are vacuumed before it rains; (2) protecting surfaces against precipitation; (3) prohibiting specific operations on selected surfaces; (4) requiring that specific methods be used on selected surfaces; (5) evaluating the trade-off between cleanup standards and decontamination costs; and (6) varying cleanup standards according to expected human exposure to the surface.

19079 (UCRL—53499/1) Nevada test site fallout atom ratios: $^{240}Pu/^{239}Pu$ and $^{241}Pu/^{239}Pu$. Hicks, H.G.; Barr, D.W. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007807.

The exposure of the population in Utah to external gamma radiation from the fallout from nuclear weapons tests carried out between 1951 and 1958 at the Nevada Test Site (NTS) has been reconstructed from recent measurements of ^{137}Cs and plutonium in soil. The fraction of ^{137}Cs in the fallout from NTS events was calculated from the total plutonium and the $^{240}Pu/^{239}Pu$ ratios measured in the soil, using the values of 0.180 +- 0.006 and 0.032 +- 0.003 for that ratio in global fallout and NTS fallout, respectively. The total population exposure from NTS events was then calculated on the basis of exposure rates resulting from short-lived radionuclides associated with the ^{137}Cs at the time of deposition. While the $^{240}Pu/^{239}Pu$ ratio is constant in global fallout, this ratio varies greatly in the fallout from individual events. While the composition of fallout on Utah from NTS events is rather uniform, the Off-Site Radiation Exposure Review Project is currently reconstructing radiation exposures for locations close to NTS where the fallout may be predominantly from one event. Therefore, the authors compiled the pertinent ratios in order to provide information concerning the exposure resulting from any individual event. The plutonium ratios measured at 30 days postshot were compiled from unpublished values in the archives of the Nuclear Chemistry Division of LLNL and INC-11 of LANL. These ratios are pertinent to fallout data. Dates for each event were taken from a publication by the Nevada Operations Office of the Department of Energy. 3 references.

19080 Radium-226 in plants and substrates at inactive uranium mill sites in the southwestern United States. Marple, M.L. (Los Alamos Scientific Lab., NM); Potter, L.D. pp 251-257 of Natural radiation environment. Vohra, K.G.; Mishra, U.C.; Pillai, K.C.; Sadasivan, S. (eds.). New York, NY; John Wiley & Sons, Inc. (1982). (CONF-810153—).

From 2. special symposium on natural radiation environment; Bombay, India (19 Jan 1981).

The uptake and translocation of contaminants from uranium mill tailings piles and other similar wastes could be an important transport mechanism of these contaminants into the environment. The content of Ra-226, the radionuclide of most concern in this context, was investigated in plants growing on inactive uranium mill tailings sites in Four Corners Region of the southwestern United States and in plants grown under greenhouse conditions with minimal surficial contamination. This study provides a basis for estimating intake levels for herbivores and for evaluating transfer coefficients.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 17987, 17991, 18026, 18040, 18091, 18158, 18182, 18216, 18229, 18645

19081 Land treatment of synfuel organic sludge,s. Davis, E.C.; Helton, M.R.; Marshall, D.S. (Oak Ridge National Laboratory, Oak Ridge TN). *Journal of Solar Energy Engineering;* **109**: No. 5, 1068-1081(Oct 1983). Contract W-7405-ENG-26.

One problem in the development of a large-scale synthetic fuels industry is solid waste and disposal-related environmental problems. Three synfuel waste water sludges (SRC-I, SRC-II, and H-Coal) and one petroleum refinery API separator sludge were chemically characterized and subjected to laboratory-scale land ap-

plication experiments. Leachate, recognized as a primary contaminant transport vector, was generated for study, and biodegradation (carbon dioxide evolution) of the organic component of sludge-soil mixtures was measured and modeled for a 245-day study period. Results indicate that the elemental composition varies considerably between wastes, with carbon being the dominant element ranging from 26% to 61% in the SRC-I and H-Coal samples, respectively. The petroleum refinery API sludge exhibited the most rapid degradation requiring only 96 days to reach 90% of the estimated maximum carbon dioxide production for that particular waste. The H-Coal material was found to be the most biodegradable, with approximately 100 mg of carbon evolved per gram of sludge. In contrast, the SRC-I sludge was more stable toward biodegradation, yielding only 3 mg of carbon per gram of sludge throughout the study period. With proper design, which includes runoff collection and treatment, land treatment is seen as an effective method of handling the relatively small volume organic-laden synfuel waste water sludges.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 17990, 18836

19082 **(EPRI-EA—3221-Vol.1) Integrated lake-watershed acidification study. Volume 1: model principles and application procedures. Final report.** Chen, C.W.; Gherini, S.A.; Hudson, R.J.M.; Dean, J.D. (Tetra Tech, Inc., Lafayette, CA (USA)). Sep 1983. 206p. Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304.

The ILWAS model has been developed to simulate the biogeochemical processes occurring along the pathways which precipitation follows as it passes through the forest canopy, soil horizons, streams, bogs, and lakes. The model accepts as input precipitation quantity, precipitation quality, ambient air quality and basin properties. It calculates the volumetric flow rates and the concentrations of cations (H^+, Ca^{2+}, Mg^{2+}, K^+, Na^+, and NH_4^+), anions (SO_4^{2-}, NO_3^-, Cl^-, and F^-), monomeric aluminum, total inorganic carbon, and an organic acid analog throughout the lake-watershed system. The model segments heterogeneous lake-watershed systems into cascades of homogeneous compartments. Precipitation is routed through the compartments using hydraulic formulations and the principle of continuity. Alkalinity is used as a master variable; major alkalinity producing and consuming reactions are simulated. Slow reactions are presented by rate expressions; fast reactions by multiphase equilibria. Modeled processes are all formulated in terms of deterministic equations. Application of the model involves eight steps: (1) system segmentation, (2) preparation of data on lake-watershed characteristics, (3) selection of model coefficients, (4) preparation of wet and dry deposition data, (5) model calibration, (6) sensitivity analysis, (7) hypotheses testing, and (8) evaluation of management scenarios. 89 references, 36 figures, 8 tables.

19083 **(FWS/OBS—82/11.5) Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico). Sea catfish and Gafftopsail catfish.** Muncy, R.J.; Wingo, W.M. (Mississippi State Univ., Mississippi State (USA)). Oct 1983. 23p. National Coastal Ecosystems Team, US Dept. of Interior Fish and Wildlife Service, Washington, DC 20240.

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are designed to assist in environmental impact assessment. Sea catfish and gafftopsail catfish are not preferred sport nor commercial fish; however, their high abundance inshore along the northern Gulf of Mexico causes them to rank 2nd or 3rd and no lower than 13th of all saltwater finfish in angler surveys. Sea catfish comprised less than 2% in industrial bottom trawl fisheries although surveys in depths to 20 m revealed they comprised 2 to 36%, by weight, of the bottom fishes. Sea catfish attain sexual maturity before 2 years of age, and spawn from May to August in shallow bays. Adult males do not feed for 60 to 80 days while carrying fertilized eggs and sac-fry in their mouths. Juveniles remain in low-salinity estuaries until decreasing water temperatures above 25°C but remain inshore at temperatures above 10°C. Sea catfish and gafftopsail catfish have been collected from waters with salinities ranging from 0 to 30 ppt, but prefer water salinities above 10 ppt. Water depth preferences of sea catfish and gafftopsail catfish appear related to water temperature, salinity, and bottom substrate. As juveniles, both species are opportunistic feeders utilizing microcrustaceans, and as adults, they feed upon detritus, microcrustaceans, and larger invertebrates. Blue crabs and shrimp are considered major food items. 70 references, 2 figures.

19084 **(FWS/OBS—82/11.9) Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Alewife/Blueback herring.** Fay, C.W.; Neves, R.J.; Pardue, G.B. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Fisheries and Wildlife Sciences). Oct 1983. 31p. National Coastal Ecosystems Team, US Dept. of the Interior Fish and Wildlife Service, Washington, DC 20240.

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are prepared to assist in impact assessment. The alewife and blueback herring, Alosa pseudoharengus and Alosa aestivalis, are important species in estuarine and marine ecosystems as links between the zooplankton they consume and top piscivores. Both anadromous and land-locked populations exist. Some individuals mature by age 3, and all mature by age 5. Repeat spawning is common. Spawning environments range from stream only a few centimeters deep to large rivers. Alewives will also spawn in ponds with an open connection to the sea. Blueback herring prefer spawning sites with fast currents and associated hard substrates, while alewives select a wider variety of sites, from standing water and oxbows to mid-river areas. Spawning occurs from April to July in the mid-Atlantic region; the onset and peak of alewife spawning precede those of blueback herring by 2 to 3 weeks. Larvae and juveniles remain in or near areas spawned before emigrating (as juveniles) to coastal areas between June and November of their first year. Emigration is apparently triggered by heavy runoff from rain and/or sharp decreases in water temperature. Adults overwinter offshore to depths of at least 110 m. Nantucket Shoals, Georges Bank, and the Gulf of Maine are important overwintering grounds. Commercial and limited recreational fisheries for these species occur; total US landings in 1981 were 3754 mt, while foreign landings were 13.9 mt. Some eggs can hatch at water temperatures between 7° and 29.5°C, but temperatures above 29.7°C are lethal. Larvae need temperatures greater than 10°C for proper development; upper lethal temperature is 31°C. 93 references, 4 figures, 1 table.

19085 **(FWS/OBS—82/11-10) Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic). Atlantic silverside.** Fay, C.W.; Neves, R.J.; Pardue, G.B. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Fisheries and Wildlife Sciences). Oct 1983. 21p. National Coastal Ecosystems Team, US Dept. of Interior Fish and Wildlife Service, Washington, DC 20240.

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are prepared to assist in environmental impact assessment. The Atlantic silverside (Menidia menidia) is an important link in estuarine food webs as an opportunistic omnivore and as forage for large piscivores such as striped bass (Morone saxatilis) and bluefish (Pomatomus saltatrix). Many times the Atlantic silverside is the most abundant fish species encountered in estuaries and tributaries. They mature at age 1 and spawn in the intertidal zone of estuaries from March to June in the mid-Atlantic region. Few 2-year-old fish are ever encountered, so the Atlantic silverside is basically a short-lived species. Most spawning occurs at high tide during new or full moon phases. Eggs are adhesive and are found attached to submerged vegetation. Larvae, juveniles, and adults generally inhabit similar areas. Sex is determined in larval development 32 to 46 days after hatching, and is a function of parental genotype and water temperature regime during the critical period. Fisheries for this species are not documented. Eggs can tolerate water temperatures between 15° and 30°C, and larvae need

temperatures above 15°C for survival. Larvae tolerate relatively acute temperature increases. Upper lethal temperatures for juveniles and adults range from 30.5° to 33.8°C, depending on acclimation temperature. Salinities of 20 ppt or lower significantly delay hatching and affect larval survival. Juveniles and adults tolerate the full range of naturally occurring salinities (i.e., freshwater to at least 37.8 ppt). 57 references, 2 figures.

19086 **(FWS/OBS—82/11.14) Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico). Bay anchovy and Striped anchovy.** Robinette, H.R. (Mississippi State Univ., Mississippi State (USA). Dept. of Wildlife and Fisheries). Oct 1983. 21p. National Coastal Ecosystems Team, US Dept. of Interior Fish and Wildlife Service, Washington, DC 20240.

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are prepared to assist in environmental impact assessment. The bay anchovy (Anchoa mitchilli) is one of the most abundant pelagic estuarine species and the striped anchovy (Anchoa hepsetus) is a common pelagic estuarine species along the entire coast of the northern Gulf of Mexico. Both fish are important forage species because of their abundance and small size. Striped anchovies may have two major spawning periods (spring and summer), but spawning of bay anchovies probably occurs throughout the year. Length-weight relationships of the bay anchovy and striped anchovy are similar. Zooplankters (especially copepods) constitute the major portion of the diet of both species. Bay anchovies and striped anchovies have been taken from water with temperatures ranging from 4.5° to 39.8°C and 15.0 to 34.9°C, respectively; from water with dissolved oxygen ranging from 1.5 mg/l to 11.9 mg/l and 3.0 mg/l to 8.7 mg/l, respectively; and from water salinity ranging from 0.0 ppt to 45.0 ppt and 0.3 ppt to 44 ppt, respectively. Bay anchovies occur more often at low salinities than do striped anchovies. 50 references, 2 figures, 3 tables.

19087 **(IAEA-TECDOC—291) Tracer methods in isotope hydrology. Proceedings of an advisory group meeting organized by the IAEA and held in Vienna, 27 September to 1 October 1982.** (International Atomic Energy Agency, Vienna (Austria)). Jul 1983. 197p. (CONF-8209207—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780144.

From Meeting on tracer methods in isotope hydrology; Vienna, Austria (27 Sep 1982).

Individual papers are indexed separately for the data bases.

19088 **(ORNL/Sub—79-7831/1) Distribution and status of Ohio River fishes.** Pearson, W.D.; Krumholz, L.A. (Louisville Univ., KY (USA). Water Resources Lab.). Feb 1984. Contract W-7405-ENG-26. 417p. NTIS, PC A18/MF A01; GPO Dep. Order Number DE84007922.

The Ohio River has been modified extensively by the activities of the nearly 40 million people living within its basin. The effects of siltation following clearing of the forests in the 19th century and the construction of a system of dams for maintaining navigation between 1900 and 1929 affected the entire river, while pollution (industrial and domestic) was most severe in the upper third of the river in the 1940's. This assesses the current status and distributions of fish in the Ohio River and relates then to river habitats and conditions. We found records of 154 species of fishes reported from the Ohio River between 1817 and 1983. Fourteen of these species were introduced by man. Only 13 species which were represented before 1970 were not found in the river between 1970 and 1983. Of these 13 species only the lake sturgeon was ever an abundant fish in the Ohio River. However, several other important or unique fishes have declined alarmingly in abundance or distribution since 1900. These include the shovelnose sturgeon, paddlefish, muskellunge, and blue sucker. The ten most-abundant fishes in collections of 1957 to 1980 were: emerald shiner, gizzard shad, freshwater drum, mimic shiner, channel catfish, common carp, bullheads, skipjack herring, white crappie, and threadfin shad. Between 1957 and 1980 fish densities increased dramatically in the upper 100 miles of the river where water quality improvements were greatest. Fish populations remained relatively stable in the lower two-thirds of the river between 1957 and 1980. 272 references, 143 figures, 32 tables.

19089 **(PB—84-138239) Regional environmental assessment: Gulf of Mexico pipeline activities.** DeWald, O.E.; Burdette, M.K.; French, C.O.; Beckert, H. (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office). Aug 1983. 185p. NTIS, PC A09/MF A01.

Pipeline installations on the Gulf of Mexico Outer Continental Shelf (OCS) have affected a wide range of living and nonliving environmental variables (i.e., water quality, biologically sensitive areas, and food-web relationships) for the past 30 years. Much of the information included herein pertains to a description of the existing environment for offshore and onshore coastal areas contiguous to the Gulf of Mexico and an analysis of potential pipeline proposals and alternatives.

19090 **(PNL-SA—10845) Factors affecting growth and survival of the asiatic clam Corbicula sp. under controlled laboratory conditions.** Double, D.D.; Daly, D.S.; Abernethy, C.S. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 20p. (CONF-8304101—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84002597.

From 7. American Society of Testing and Materials symposium on aquatic toxicology; Milwaukee, WI, USA (17 Apr 1983).

Growth of Corbicula sp. was determined in relation to food supply, water temperature, and clam size as an aid to researchers conducting chronic effects toxicity studies. Water temperatures for the two 84-day test series were 10, 20, and 30°C. Linear models provided good relationships ($r^2 > 0.90$) between clam shell length (SL), total weight (TW), and wet/dry tissue weights. Clam growth was minimal during low phytoplankton densities (~ 300 cells/ml), and all three size groups lost weight at 20 and 30°C. Mortality of small clams at 30°C was 100% after 71 days. At phytoplankton densities > 1000 cells/ml, overall differences in growth with respect to clam size and temperature were detectable at $p < 0.01$; growth of all clam groups was greatest at 30°C. Small clams exhibited the greatest absolute increase in mean shell length at all test temperatures, and weight gains were similar to those of medium and large clams.

19091 **(TVA/OECD/FPM—83/25) Revised flood hazard data on West Chickamauga Creek in the vicinity of Chattanooga, Tennessee.** (Tennessee Valley Authority, Knoxville (USA). Office of Economic and Community Development). Dec 1982. 16p. NTIS, PC A02/MF A01. Order Number DE84900790.

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This report provides flood hazard information for the portion of West Chickamauga Creek (stream mile 0.00 to mile 0.93) which lies within the corporate limits of Chattanooga, Tennessee. TVA previously prepared the information contained in the 1980 flood insurance study published by the Federal Emergency Management Agency (FEMA). In mid-1977, the US Geological Survey (USGS) published a major revision of flood discharge records for the former gage on West Chickamauga Creek near Kensington, Georgia. This gage is the primary source of hydrologic data used to establish floodflow frequencies for this section of West Chickamauga Creek. An analysis of the gage data revision revealed a substantial change in the previously published information. FEMA has revised or intends to revise the flood insurance study maps and profiles to reflect these changes.

19092 **(TVA/OECD/FPM—83/26) Revised flood hazard data on West Chickamauga Creek in the vicinity of East Ridge, Tennessee.** (Tennessee Valley Authority, Knoxville (USA). Office of Economic and Community Development). Dec 1982. 16p. NTIS, PC A02/MF A01. Order Number DE84900789.

This report provides flood hazard information for the portion of West Chickamauga Creek (stream mile 0.00 to mile 3.15) which lies within the corporate limits of East Ridge, Tennessee. TVA previously prepared the information contained in the 1980 flood insurance study published by the Federal Emergency Management Agency (FEMA). In mid-1977 the US Geological Survey (USGS) published a major revision of flood discharge records for the former gage on West Chickamauga Creek near Kensington,

Georgia. This gage is the primary source of hydrologic data used to establish floodflow frequencies for this section of West Chickamauga Creek. An analysis of the gage data revision revealed a substantial change in the previously published information. FEMA has revised or intends to revise the flood insurance study maps and profiles to reflect these changes.

19093 **(TVA/OECD/FPM—83/33) Revised flood hazard data on West Chickamauga Creek in the vicinity of Catoosa County, Georgia.** (Tennessee Valley Authority, Knoxville (USA). Office of Economic and Community Development). Mar 1983. 82p. NTIS, PC A05/MF A01. Order Number DE84900788.

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5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 18058, 18059, 18060, 19035, 19062, 19066, 19088, 19162

19094 **(DOE/ER—0177) Subsurface transport with emphasis on hydrology: research needs. Subsurface Transport Program.** Zachara, J.M.; Wildung, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1982. Contract AC06-76RL01830. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007667.

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A number of energy technologies presently in operation or under development generate solid wastes in large quantities as a major byproduct. These wastes will, for the most part, be disposed to the ground in landfills or inactive mine sites. Although the waste materials differ significantly among technologies, most contain residual, water-soluble chemical components which are of ecological and human health concern. Thus, in ground disposal may have a significant long-term impact on water supplies and human health if not properly conducted. With the growing magnitude of solid waste disposal operations, it becomes imperative to establish common ground between technologies such that research in this complex area can be efficiently managed to benefit a variety of users. This report develops the concept of multitechnology or generic research in subsurface transport with emphasis on hydrogeochemistry. Initially, a generic research approach was developed independent of waste characteristics. This approach both identified and prioritized the research information or experimentation and data management tools (models) required to resolve major technical concerns for in ground disposal. Waste characteristics were then evaluated to identify the common, cross-technology information needs. This evaluation indicated that solid wastes from energy producing technologies have physiocochemical properties in common which serve as a useful basis for identification of fundamental, generic research needs. Priority research projects are suggested for addressing contaminant identification, solubilization, transformation and transport. 38 references, 3 tables.

19095 **(ORNL/TM—8894) Mercury contamination in East Fork Poplar Creek and Bear Creek.** Van Winkle, W.; Counts, R.W.; Dorsey, J.G.; Elwood, J.W.; Lowe, V.W. Jr.; McElhaney, R.; Schlotzhauer, S.D.; Taylor, F.G. Jr.; Turner, R.R. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84007510.

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A one-month study was performed to determine the concentration of mercury in sediment, fish, moss, and pasture grass in the East Fork Poplar Creek (EFPC) and Bear Creek drainages and to determine whether mercury is still being released from the Y-12 Plant. Total mercury concentration in a sediment core from New Hope Pond was 100 μg/g dry wt at the surface and up to 300 μg/g dry wt in subsurface sediments, relative to background concentrations of less than 0.3 μg/g dry wt. There has been an apparent decrease since 1973 in mercury concentration of sediment entering New Hope Pond. Total mercury concentration in muscle tissue of bluegill from EFPC was positively correlated with body weight, as expected. Total mercury concentration averaged 3.5 and 0.2 μg/g fresh wt for dead and live foliage in pasture grass, respectively, on the flood plain of EFPC. Results for Bear Creek indicate that this drainage is considerably less contaminated with mercury than East Fork Poplar Creek. The concentration in the sediment was 13 μg/g dry wt near the settling basins at the west end of the Y-12 Plant area, but decreased to background concentrations before the confluence of Bear Creek with EFPC. Total mercury concentration in fish, except for one rock bass, did not exceed the FDA action level. Recommendations are made (1) to limit the quantity of mercury released from the Y-12 Plant area into EFPC, (2) to consider notifying the responsible state agencies and fishermen concerning mercury concentrations found in fish in EFPC, and (3) to measure mercury concentration in hair from cattle grazing on pasture grasses along EFPC. Recommendations concerning further monitoring are also made. 15 references, 3 figures, 8 tables.

19096 **(PB—84-132539) Cross-current flotation for metal removal from plating wastes.** Barnett, S.M.; DeLuise, F.J.; Nir, E. (Rhode Island Univ., Kingston (USA). Water Resources Center). Sep 1983. 14p. NTIS, PC A02/MF A01.

While countercurrent flotation pilot plants have been shown to be effective and economical in removing metals such as cobalt, copper, lead, zinc and iron by means of various precipitate flotation techniques, many plating facilities have troughs or other horizontal conduits which would make flotation more economically attractive if these existing channels could be adapted for such use. The purpose of this study was to investigate the feasibility of crosscurrent precipitate flotation for these troughs. The metals investigated were copper, nickel and lead. The most important trend found in the results is that the shorter trough more effectively removes metals by precipitate flotation for a given pH and given flow rates than the longer trough. Thus, the horizontal flotation process should be done over a minimum length to avoid undersized enrichment of the water due to foam breakage.

19097 **(PB—84-133750) Analysis of the NBS (National Bureau of Standards) sediment by the MRI (Midwest Research Institute) sludge protocol. Final report.** Lopez-Avila, V.; Northcutt, R.V.; Onstot, J.; Wickham, M. (Midwest Research Inst., Kansas City, MO (USA)). Jan 1984. 152p. NTIS, PC A08/MF A01.

An extraction technique, involving homogenization of a sediment sample with dichloromethane at dual pH and phase separation by centrifugation, was used in the determination of fifty-one organic priority pollutants as identified in a standard reference sediment sample. The extract containing the base/neutral compounds was fractionated by gel permeation chromatography (GPC). Separation and identification of individual compounds in the silica gel fractions was accomplished by gas chromatography/mass spectrometry (GC/MS). Method precision and accuracy are discussed. Tentative identifications of other organic compounds found in the sediment are given.

19098 **(PB—84-134337) Development and evaluation of methods for total organic halide and purgeable organic halide in wastewater. Report for September 1980-October 1981.** Riggin, R.M.; Lucas, S.V.; Lathouse, J.; Jungclaus, G.A.; Wensky, A.K. (Battelle Columbus Labs., OH (USA)). Jan 1984. 126p. NTIS, PC A07/MF A01.

This report describes a series of studies involving the use of 'surrogate' methods for the determination of total organic halides (TOX), purgeable organic halides (POX), and solvent extractable organic halides (EOX), in wastewater and solid wastes. A pyrolysis/microcoulometric system was used as the analytical detection device for all studies. Method performance data are presented for the various surrogate methods. The results obtained using the surrogate methods were compared to those obtained using compound-specific methods based on gas chromatography (GC) or combined gas chromatography-mass spectrometry (gc/MS). The advantages and limitations of using the surrogate methods in place of more sophisticated procedures are discussed.

19099 **(PB—84-136803) Impact of changing acidity on the trophic dynamics of pine barrens plankton communities. Final report.** Morgan, M.D. (Rutgers--the State Univ., Camden, NJ (USA). Dept. of Biology). Sep 1983. 48p. NTIS, PC A03/MF A01.

The physical, chemical, and biological limnology of Oswego Lake (an undisturbed New Jersey Pine Barrens pond), and Nescochague Lake (a pond disturbed by extensive agricultural and residential development) was investigated from June 1981 - May 1983. The impact of disturbance was most evident in pH and nutrients. On all occasions, the pH of Nescochague Lake (mean, based on H(+) concentration = 5.3, range 4.5-7.8) exceeded the pH of Oswego Lake (mean - 4.2, range 3.9-4.6). Concentrations of NO^3-N and total P were about 50 times greater in Nescochague Lake than in Oswego Lake. The biological response to these differences was most evident among the phytoplankton, which exhibited both greater biomass and productivity. These periodic reductions in pH apparently restricted the zooplankton to a primarily acid tolerant assemblage, thus, explaining the overall similarity between the communities in Oswego and Nescochague Lakes.

19100 **(PB—84-137710) Determination of dioxin levels in carbon reactivation process effluent streams. Final report, 1 May 1982-15 April 1983.** Howes, J.E. Jr; DeRoos, F.L.; Aichele, D.; Kohler, D.F.; Larson, M.E. (Battelle Columbus Labs., OH (USA)). Jan 1984. 142p. NTIS, PC A07/MF A01.

A preliminary study was performed to evaluate the potential formation and persistence of tetrachlorodibenzo-p-dioxins (TCDDs) and tetrachlorodibenzo furans (TCDFs) in the effluent streams of a fluidized bed system used for thermal reactivation of granular activated carbon (GAC) that had been used for treating Cincinnati, Ohio municipal drinking water.

19101 **(PB—84-138049) Health hazard evaluation report No. HETA 81-388-1129, Santa Cruz Metropolitan Transit District, Santa Cruz, California.** Belanger, P.; Coye, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1982. 22p. NTIS, PC A02/MF A01.

On August 19-20, 1981, environmental and medical surveys were conducted during diesel and gasoline bus servicing. Based on the environmental air samples collected during the dates of the survey, overexposure to CO, CO_2, SO_2, NO_2, and total particulate did not exist. However, significant short-term exposures to formaldehyde were measured depending on workers job task, the time of the shift, and the mechanical condition of the bus. The symptoms reported and/or experienced by the workers are generally consistant with formaldehhde exposure and diesel fume exposure.

19102 **(PB—84-138254) Health hazard evaluation report No. HETA 81-452-1128, Santa Cruz Metropolitan Transit District, Santa Cruz, California.** Belanger, P.; Coye, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1982. 21p. NTIS, PC A02/MF A01.

On September 23-25, 1981, peak CO concentrations averaged 6 ppm and peak total hydrocarbon concentrations 3 ppm. No overexposures to CO or alkanes were measured based on NIOSH-recommended time-weighted average criteria (CO--35 ppm; alkanes C5 to C8--350 mg/cu m). The CO_2, NO_2, and SO_2 air concentrations were below the limit of detection. No formaldehyde was detected. Total particulate (soot) ranged from none detectable to 0.06 mg/cu m. However, the diesel bus drivers (8) reported a high prevalence of eye and upper respiratory symptoms, while the gasoline bus drivers reported a high prevalence of headaches and upper respiratory irritation. Drivers of diesel engine buses were not overexposed to CO_2, SO_2, NO_2, formaldehyde, total particulate, or polynuclear aromatic hydrocarbons, even though diesel fumes were periodically smelled when the engine was at idle.

19103 **(PB—84-138742) Plume concentration algorithms with deposition, sedimentation, and chemical transformation. Technical memo.** Rao, K.S. (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Air Resources Labs.). Nov 1983. 100p. (NOAA-TM-ERL-ARL—124). NTIS, PC A05/MF A01.

A gradient-transfer model for the atmospheric transport, diffusion, deposition, and first-order chemical transformation of gaseous and particulate pollutants emitted from an elevated continuous point source is formulated and analytically solved using Green's functions. This analytical plume model treats gravitational settling and dry deposition in a physically realistic and straightforward manner. For practical application of the model, the eddy diffusivity coefficients in the analytical solutions are expressed in terms of the widely-used Gaussian plume dispersion parameters. The latter can be specified as functions of the downwind distance and the atmospheric stability class within the framework of the standard turbulence-typing schemes. The new point-source algorithms are applied to study the atmospheric transport and transformation of SO2 to SO4(-2), and deposition of these species. The work described in this report was undertaken to develop concentration algorithms for the Pollution Episodic Model (PEM).

19104 **(PB—84-138841) Relationship between global fossil-fuel consumption and the concentration of carbon dioxide in the atmosphere, Part 2. Final report, October 1979-March 1982.** Marland, G. (Oak Ridge Associated Universities, Inc., TN (USA)). Jun 1983. 133p. NTIS, PC E06/MF A01.

This study has involved a complete review of the historic rate of CO_2 discharge to the atmosphere from fossil fuel burning. Considering the rates of fuel production, variability of fuel composition, and variety of fuel uses, we have calculated a time series for CO_2 emissions since 1950. The results are consistent with, and hence substantiate earlier that were based on less clear fuel statistics. A mathematical model of the global carbon cycle has been developed and documented so that we can test how, for example, various hypotheses of future fuel use or improved understanding of biospheric or oceanic processes will affect our perception of future levels of atmospheric CO_2.

19105 **(PB—84-140508) Characterization of the Chesapeake Bay: A systematic analysis of toxic trace elements.** Kingston, H.M.; Greeberg, R.R.; Beary, E.S.; Hardas, B.R.; Moody, J.R. (National Bureau of Standards, Washington, DC (USA)). Nov 1983. 227p. (NBSIR—83-2698). NTIS, PC A11/MF A01.

As part of a multidisciplinary study of the Chesapeake Bay, the National Bureau of Standards (NBS) was asked to develop the techniques and procedures necessary to measure the trace and toxic element concentrations within the water column through the entire length of the Chesapeake Bay. The Inorganic Analytical Research Division of the Center for Analytical Chemistry at NBS has completed the analysis for selected elements (Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sc, Sn, Th, U, and Zn), including some elements at concentrations consistently below one picogram per milliter (part per trillion).

19106 **Hydrocarbons in the Isla Vista marine seep environment.** Stuermer, D.H.; Spies, R.B.; Davis, P.H.; Ng, D.J.; Morris, C.J.; Neal, S. (Lawrence Livermore National Lab., CA). *Marine Chemistry (Amsterdam);* **11**: 413-426(1982). Contract W-7405-ENG-48.

Hydrocarbon analyses on samples of sediment, interstitial water, and dissolved and particulate fractions of the water column from the vicinity of the Isla Vista seep near Santa Barbara, California, are presented. The results demonstrate that a very heterogeneous distribution of hydrocarbon composition and concentration exists in the seep environment and that the life-style and feeding habits of the organisms in this environment will have a dramatic effect on their hydrocarbon exposure. 7 figures, 2 tables.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 18218, 18225, 18236, 18239, 18248, 18251, 18252, 18254, 18255, 18257, 18258, 19055, 19077, 19094

19107 (AECL—8098) Concentration of ^{137}Cs in water and fish from the Winnipeg River, Canada. Dunford, W.E.; Acres, O.E.; Pollock, R.W. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). 1983. 13p. (IAEA-SR—85/13). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900674.

The concentration of ^{137}Cs in water and fish from the Winnipeg River, Canada, has been determined upstream and downstream of the Whiteshell Nuclear Research Establishment (WNRE) in central Canada since 1962. From 1976 to 1982, releases of ^{137}Cs from WNRE contributed from 33% (1982) to 75% (1979) of the total ^{137}Cs downstream. The WNRE contribution was reflected in concentrations in water downstream of 0.010 to 0.025 Bq/L, and average concentrations in fish downstream of 6 to 28 Bq/kg. Over the same period, five species of upstream fish contained average annual concentrations of ^{137}Cs ranging from 1 to 4 Bq/kg. Bioaccumulation factors were calculated for all fish, and, in general, the average values for fish-eating species ranged from 1200 to 2500 (wet weight), and for bottom feeders from 300 to 1000, with some noted exceptions. These bioaccumulation factors are somewhat lower than values reported in the literature for waters with similar chemical characteristics.

19108 (DPST—83-829-Vol.2) Technical summary of Groundwater Quality Protection Program at Savannah River Plant. Volume II. Radioactive waste. Stone, J.A.; Christensen, E.J. (eds.). (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Dec 1983. Contract AC09-76SR00001. 126p. NTIS, PC A07/MF A01; GPO Dep. Order Number DE84008171.

This report (Volume II) presents representative monitoring data for radioactivity in groundwater at SRP. Four major groups of radioactive waste disposal sites and three minor sites are described. Much of the geohydrological and and other background information given in Volume I is applicable to these sites and is incorporated by reference. Several of the sites that contain mixed chemical and radioactive wastes are discussed in both Volumes I and II. Bulk unirradiated uranium is considered primarily a chemical waste which is addressed in Volume I, but generally not in Volume II.

19109 (LA—9896-PR) Water supply at Los Alamos during 1982. Purtymun, W.D.; Becker, N.M.; Maes, M. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 47p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008358.

Municipal and industrial water supply for Los Alamos during 1982 consisted of 1512 x 10^6 gal from wells in three fields and 46 x 10^6 gal from the gallery in Water Canyon. Less than 3 x 10^4 gal of water were pumped to waste during testing of well LA-6. About 3.4 x 10^6 gal of water from Guaje Reservoir and 2.8 x 10^6 gal from Los Alamos Reservoir were used for irrigation; thus, the total use was about 1564 x 10^6 gal. The failure of pumps in several of the wells in 1982 did not reuslt in a water shortage because of a low peak demand period in the summer, and some of the lost production was offset as supply well PM-4 began production in July 1982. Well PM-5 was completed in 1982; however, equipping the well and construction of the pump station and transmission line will probably not be completed until early 1984. The primary and secondary chemical quality of water from the wells and distribution system is in compliance with federal regulations. Radioactivity in the water is low and naturally occurring. 17 references, 20 figures, 9 tables.

19110 (NIRS-M—39) Proceedings of the 8th National Inst. of Radiological Sciences environmental seminar on biological concentration in the ocean and factors influencing it. (National Inst. of Radiological Sciences, Chiba (Japan)). 1981. 372p. (CONF-8011205—). NTIS (US Sales Only), PC A16/MF A01. Order Number DE84780137.

From 8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it; Chiba, Japan (27 Nov 1980).

Individual abstracts are indexed in the data bases.

19111 (NIRS-RSD—53) Radioactivity survey data in Japan. (National Inst. of Radiological Sciences, Chiba (Japan)). Jun 1980. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84780146.

Individual papers are included in the data bases.

19112 (PB—84-138023) Environmental safety: April 1979. Quarterly report. (Regional Research Lab., Hyderabad (India)). Apr 1979. 138p. NTIS, PC E07/MF E07.

Contents: Feature articles; Pesticides; Chemicals; Medicine, Health and hygiene; Environment.

19113 (PB—84-138031) Environmental safety, January 1979. Quarterly report. (Regional Research Lab., Hyderabad (India)). Jan 1979. 100p. NTIS, PC E05/MF E05.

Contents: Feature articles; Pesticides; Chemicals; Medicine, Health and Hygiene; Environment.

19114 (PNL—4896) Water balance at an arid site: a model validation study of bare soil evaluation. Jones, T.L.; Campbell, G.S.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1984. Contract AC06-76RL01830. 56p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009380.

This report contains results of model validation studies conducted by Pacific Northwest Laboratory (PNL) for the Department of Energy's (DOE) National Low Level Waste Management Program (NLLWMP). The model validation tests consisted of using unsaturated water flow models to simulate water balance experiments conducted at the Buried Waste Test Facility (BWTF) located at the Department of Energy's Hanford site, near Richland, Washington. The BWTF is a lysimeter facility designed to collect field data on long-term water balance and radionuclide tracer movement. It has been operated by PNL for the NLLWMP since 1978. An experimental test case, developed from data collected at the BWTF, was used to evaluate predictions from different water flow models. The major focus of the validation study was to evaluate how the use of different evaporation models affected the accuracy of predictions of evaporation, storage, and drainage made by the whole model. Four evaporation models were tested including two empirical models and two mechanistic models. The empirical models estimate actual evaporation from potential evaporation; the mechanistic models describe water vapor diffusion within the soil profile and between the soil and the atmosphere in terms of fundamental soil properties, and transport processes. The water flow models that included the diffusion-type evaporation submodels performed best overall. The empirical models performed poorly in their description of evaporation and profile water storage during summer months. The predictions of drainage were supported quite well by the experimental data. This indicates that the method used to estimate hydraulic conductivity needed for the Darcian submodel was adequate. This important result supports recommendations for these procedures that were made previously based on laboratory results.

19115 Mobility and bioavailability of uranium mill tailings contaminants. Dreesen, D.R. (Los Alamos National Lab., NM); Williams, J.M.; Marple, M.L.; Gladney, E.S.; Perrin, D.R. *Environmental Science and Technology;* **16**: No. 10, 702-709(Oct 1982).

An evaluation of environmental transport and contamination resulting from the release of trace elements and radionuclides from uranium mill tailings was performed by utilizing both laboratory and field studies. The composition of tailings showed the enrichment of a suite of uranium analogue elements (As, Mo, Se, and V) as well as the frequent occurrence of heavy metals generally associated with sulfide minerals (Co, Cu, Ni, and Pb). Aqueous leaching of alkaline tailings mobilized base labile (anionic) species As, Mo, Se, and U, wheras acid tailings leachates contained appreciable Co and Ni. The assimilation of mobile constituents by the roots of

native plant species was most evident for Mo and Se in alkaline tailings; levels of these contaminants reported to be toxic to grazing animals were found. The laboratory studies on contaminant mobility and bioavailability are compared with contamination of water, soil, and biota by Mo and U in the vicinity of an alkaline-leach uranium mill. 6 tables.

19116 **Radionuclides in Mono Lake, California.** Simpson, H.J. (Columbia Univ., Palisades, NY); Trier, R.M.; Toggweiler, J.R.; Mathieu, G.; Deck, B.L.; Olsen, C.R.; Hammond, D.E.; Fuller, C.; Ku, T.L. *Science (Washington, D.C.);* **216**: 512-235(Apr 1982).

Several radioisotopes of the naturally occurring uranium and thorium decay series, in addition to fallout plutonium have unusually high concentrations in the water column of Mono Lake, a natural alkaline, saline lake. Complexing by carbonate ions appears to be responsible for the enhanced solubility of actinide elements with oxidation states of IV to VI. In contrast, fallout strontium-90 has been largely removed from the water, probably as a result of coprecipitation with calcium carbonate. The daughter/parent activity ratios of thorium, radium, and uranium isotopes suggest that thorium is removed from the water column to the sediments on time scales substantially longer than a month and that the desorption of thorium from the sediments to the water column requires less than a few years. 2 tables.

19117 **Hydrologic factors and ^{90}Sr transport: a case study.** Huff, D.D.; Farrow, N.D.; Jones, J.R. (Oak Ridge National Lab., TN). *Environmental Geology (New York);* **4**: 53-63(1982). Contract W-7405-ENG-26.

Lack of runoff control is probably the most important potential source of problems in the operation of solid, low-level radioactive waste disposal areas. Solid waste disposal area (SWDA) 4 at Oak Ridge National Laboratory is an example of the combined effects of hydrologic factors and burial ground operations on radionuclide transport. Results from a study of ^{90}Sr transport at SWDA 4 show that both surface water and groundwater flows are important runoff control considerations and may vary in relative importance over an extended period of time. For the area studied, it is currently estimated that at least 80% of the ^{90}Sr transport is directly related to surface runoff. Therefore, it is concluded that the key to remedial action at SWDA 4 is to control surface runoff. 9 figures, 3 tables.

19118 **Sediment mixing and accumulation rate effects on radionuclide depth profiles in Hudson estuary sediments.** Olsen, C.R.; Simpson, H.J.; Peng, T.H.; Bopp, R.F.; Trier, R.M. (Columbia Univ., Palisades, NY). *Journal of Geophysical Research;* **86**: No. C11, 11,020-11,028(Nov 1981).

Measured anthropogenic radionuclide profiles in sediment cores from the Hudson River estuary were compared with profiles computed by using known input histories of radionuclides to the estuary and mixing coefficients which decreased exponentially with depth in the sediment. Observed ^{134}Cs sediment depth profiles were used in the mixing rate computation because reactor releases were the only significant source for this nuclide, whereas the inputs of ^{137}Cs and /sup 239,240/Pu to the estuary were complicated by runoff or erosion in upstream areas, in addition to direct fallout from precipitation. Our estimates for the rates of surface sediment mixing in the low salinity reach of the estuary range from 0.25 to 1 cm^2/yr, or less. In some areas of the harbor adjacent to New York City, where fine-particle accumulation rates are generally 3 cm/yr, and often as high as 10 to 20 cm/yr, sediment mixing rates as high as 10 cm^2/yr would have little effect on radionuclide peak distributions. Consequently, anthropogenic radionuclide maximum activities in subsurface sediments of the Hudson appear to be useful as time-stratigraphic reference levels, which can be correlated with periods of maximum radionuclide inputs for estimating rates and patterns of sediment accumulation. 10 figures.

19119 **Plutonium, radiocesium and radiocobalt in sediments of the Hudson River estuary.** Olsen, C.R.; Simpson, H.J.; Trier, R.M. (Columbia Univ., Palisades, NY). *Earth and Planetary Science Letters;* **55**: 377-392(1981).

Anthropogenic radionuclides have reached the Hudson estuary as global fallout from nuclear weapons testing and through local releases from commercial nuclear reactors. Significant activities of ^{238}Pu and /sup 239,240/Pu (fallout-derived), ^{134}Cs and ^{60}Co (reactor-released), and ^{137}Cs (derived from both sources), have accumulated in the sediments throughout the estuary, with the primary zone of accumulation near the downstream end of the system in New York harbor. The estuary appears to have trapped nearly all of the /sup 239,240/Pu delivered as fallout, and consequently, ocean dumping of dredged harbor sediment is currently the primary means for the net transport of these nuclides to coastal waters. In contrast, only 10-30% of the ^{137}Cs, ^{134}Cs and ^{60}Co delivered to the estuary have been retained on the fine particles which accumulate at a rapid rate in the harbor. The primary factors which have governed the distribution of anthropogenic radionuclides in Hudson sediments are: 1) spread of fine particles labeled with both fallout and reactor nuclides throughout the axis of the estuary; 2) differences in timing of the peak fallout years (1962-1964) and years of maximum reactor releases (1971-1972); 3) large variations in sediment accumulation rates, ranging from a few millimeters per year or less to many tens of centimeters per year; 4) appreciable desorption of ^{137}Cs and ^{134}Cs from particles at higher salinities; and 5) possible enhanced desorption of ^{60}Co at higher salinities (relative to ^{134}Cs and ^{137}Cs) which may be associated with the release of reduced manganese from the harbor sediments. 6 figures, 6 tables.

19120 **Fallout plutonium in an alkaline, saline lake.** Simpson, H.J. (Columbia Univ., Palisades, NY); Trier, R.M.; Olsen, C.R.; Hammond, D.E.; Ege, A.; Miller, L.; Melack, J.M. *Science (Washington, D.C.);* **207**: 1071-1073(Mar 1980).

Plutonium isotopes, derived from global fallout following atmospheric testing of nuclear weapons, have been measured in the water and sediments of a natural alkaline, saline lake. The activities of fallout plutonium in the water column are about two orders of magnitude greater than in most freshwater lakes, where these nuclides are found predominantly in the sediments. 2 tables.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 19194, 19196

19121 **(TVA/ONR/WRF—83/14(a)) Responses of selected aquatic biota in Watts Bar Reservoir to thermal discharges from Kingston Steam-Electric Plant in 1978 and 1979.** Craven, T.M.; Dycus, D.L.; Tomljanovich, D.A. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources). Jul 1983. 88p. NTIS, PC A05/MF A01. Order Number DE84900343.

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Results of the 1978 and 1979 investigations on the effects of the power plant on the biota of Watts Bar Reservoir are presented and compared to the results of the 1973 to 1975 studies. Water chemistry, phytoplankton, periphyton, zooplankton and benthic macroinvertebrate data were collected. Water quality parameter values in 1978 and 1979 were within expected ranges. Upstream/downstream differences in phytoplankton density in 1978 and 1979 were not attributed to thermal effects but to plant operation. Lower cell density and chlorophyll a concentrations in 1979 were attributed to increased turbidity accompanying higher flows. Low abundance of blue-green algae (Cyanophyta) at thermally affected stations suggested that differences in composition among stations were not due to thermal effect but to complex mixing patterns of several water masses. Thermal effluent was not shown to adversely affect the periphyton community downstream of the plant. Substantial differences in zooplankton density between upstream and downstream stations were indicative of some type of plant effect. No adverse effects were observed on the benthic macroinvertebrate community in either 1978 or 1979. 57 references, 17 figures, 23 tables. (MDF)

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 17992, 18026, 19109, 19126, 19128

19122 (PB—84-132547) Final environmental impact statement for proposed OCS oil and gas lease offerings, central Gulf of Mexico, April 1984 and western Gulf of Mexico, July 1984. Brashier, J.; Beckert, H.; Rouse, M. (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office). Dec 1983. 514p. NTIS, PC A22/MF A01.

This Environmental Impact Statement (EIS) is a description of the environmental aspects and impacts of oil and gas activities resulting from these lease offerings for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major alternatives of holding these lease offerings.

19123 (SRO-NERP—12) Fishes of the Savannah River Plant: National Environmental Research Park. Bennett, D.H.; McFarlane, R.W. (Savannah River Ecology Lab., Aiken, SC (USA)). Aug 1983. Contract AC09-76SR00819. 153p. NTIS, PC A08/MF A01; GPO Dep. Order Number DE84007323.

An update of the taxonomic, distributional and ecological information on fish inhabiting waters adjacent to the DOE Savannah River Plant (SRP) is provided. Information on the SRP, ground and surface water, habitat types, historical aspects, and relative abundance of fishes (in both lotic and lentic ecosystems) is provided. In addition, a glossary, an annotated bibliography and keys to fish families and species are included. 131 references, 22 figures, 4 tables.

19124 (TVA/ONR/WRF—83/16) Raccoon Mountain pumped-storage facility operational fish monitoring report. Buchanan, J.P.; Pasch, R.W.; Smith, A.O.; Swor, C.T.; Tomljanovich, D.A. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources). Sep 1983. 171p. NTIS, PC A08/MF A01. Order Number DE84900342.

The impact of the Raccoon Mountain Pumped-Storage Facility operations on fisheries resources in the Nickajack Reservoir was investigated. Analyses of data collected from 1979 through 1981 on population status and distribution of adults, larvae and eggs are presented with comparisons of preoperational fisheries monitoring data collected by the TVA from 1977 through 1978. Although minor differences in composition of dominant species, and slight declines in standing stock of some species were noted, no major impacts were identified. Appendix B contains a short report entitled Nickajack Reservoir Ictiobine Study 1979 by Edwin Scott Jr. 7 references, 46 figures, 31 tables.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 18152, 18156, 18641, 18646

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 18332, 19122

19125 (DOE/EIS—0107-D) Mead-Phoenix +- 500kV dc transmission line projects: maps, diagrams & tables. (USDOE, Washington, DC). Nov 1983. 288p. NTIS, PC A13/MF A01; 1; GPO Dep. Order Number DE84007287.

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This is the draft environmental impact statement (DEIS) for the proposed Mead-Phoenix +- 500-kV dc Transmission Line Project (DOE/EIS-0107-D) in Arizona and southern Nevada. The DEIS addresses the proposal to construct, operate and maintain a 500-kV direct current (dc) transmission line from Mead Substation near Boulder City in southern Nevada to the proposed Eastwing Terminal near Phoenix, Arizona. There will be alternating current (ac)/dc converter stations at each end of the transmission line. Ancillary facilities include communication facilities for the line and approximately 20 miles of distribution-type lines to the ground electrode for each terminal. Power transfer capability of the dc transmission line would be initially rated at 1600 megawatts (MW) with ultimate capacity of transmitting up to 2200 MW. The DEIS has been prepared to fulfill the requirements of the National Environmental Policy Act of 1969 and related statutes and regulations. The environmental setting of the proposed project area and the environmental consequences of the proposed action and alternative actions, including the no-action alternative, are discussed.

19126 (EIS—4900249) Proposed North Atlantic lease offering, April 1984. Final environmental impact statement; visuals; index. (Minerals Management Service, New York (USA). Atlantic OCS Region). Apr 1984. 886p. US Dept. of the Interior, Minerals Management Service, 18th and C Sts., NW, Washington, DC 20240.

The proposed action is to offer a maximum of 4366 blocks located from 19 to 256 statute miles offshore Cape Cod and Nantucket Island, Massachusetts for leasing in accordance with the Outer Continental Shelf Lands Act, as amended. The lease offering is scheduled for April 1984. As a result of a Congressional moratorium enacted through appropriations legislation, blocks in certain areas may not be offered during fiscal year 1984. Alternatives evaluated include a delay of the lease offering, cancelling the lease offering (no action), and eight block deletion alternatives. One option would delete all blocks within 50 statute miles offshore. A second would delete 106 blocks in canyon areas. A third would delete 224 blocks in canyon areas. A fourth would delete all blocks within the 60-meter isobath. A fifth would extend the 60-meter alternative to the north and east (Northeast Peak). A sixth would delete 404 blocks, and a seventh would extend this to the south to totally delete the Great South Channel. An eighth would eliminate all blocks within traffic separation schemes and a precautionary area from the offering. A ninth would delete blocks along the shelf break zone. A final option would delete 1542 blocks in the canyons, in the Great South Channel, within the 60-meter isobath, closer to shore than 50 miles, and within the traffic separation schemes. The Congressional moratorium mandates that the Department of the Interior select this final alternative, at a minimum, if it proceeds with the offering. The leasing of all blocks studied would pose some risk to the environment. Mitigating measures that reduce risk have been identified and evaluated. 452 references, 61 figures, 67 tables.

19127 (FERC/EIS—0010) Dinkey Creek Project No. 2890, California. Final environmental impact statement. (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Aug 1980. 311p. NTIS, PC A14; 3; GPO Dep. Order Number DE84006841.

Paper copy only, copy does not permit microfiche production.

Kings River Conservation District (Applicant) is proposing to construct a 120-megawatt hydroelectric project on Dinkey Creek in the Sierra National Forest east of Fresno, California. This action would require construction of a 380-foot-high dam on Dinkey Creek and thereby create a reservoir of approximately 865 surface acres; construction of two powerhouses; construction of a power tunnel approximately 10 miles in length and 3 diversion tunnels totalling approximately 4 miles in length; and access roads. Transmission lines would not be a part of the project. Work on the project, including engineering, would extend for approximately 5 years.

19128 (FERC/EIS—0020) Final environmental impact statement: South Fork American River Development, Upper Mountain Project, No. 2761, California. (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). May 1981. 305p. NTIS, PC A14/MF A01; 1; GPO Dep. Order Number DE84009433.

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El Dorado County Water Agency and El Dorado Irrigation District (joint applicants), of Placerville, California propose to construct a conventional hydroelectric and water supply project with

an installed generating capacity of 110.4 MW on the South Fork American River and tributaries in El Dorado County, California. The action would require two major diversion structures (dams), one each on the upper South Fork American River and the Silver Fork American River; seven minor diversion structures on tributaries of the South and Silver forks of the American River; a major diversion structure (dam) and storage reservoir on Alder Creek, a tributary of the South Fork American River; approximately 34 miles of water conveyance structures; three powerhouses; approximately 29 miles of transmission lines; three new access roads; new and improved recreational facilities; and other appurtenant facilities. Construction would commence subsequent to issuance of a license. 141 references, 37 figures, 43 tables.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 19139, 19141, 19143, 19144, 19160, 19218

19129 **(AD-A—136111/2) Unitary cause for the exclusion of Na(+) and other solutes from living cells, suggested by effluxes of Na(+), d-arabinose and sucrose from normal, dying and dead muscles.** Ling, G.N.; Walton, C.L.; Ochsenfeld, M.M. (Pennsylvania Hospital, Philadelphia (USA). Dept. of Molecular Biology). 1983. 35p. NTIS, PC A03/MF A01.

The effluxes of labelled Na(+), D-arabinose, and sucrose from normal muscle and muscle poisoned with low concentrations of iodoacetate were studied. The procedure involved repeated loading with isotope, followed by washing of the same muscle while still normal and at different stages of dying. The rates of Na(+) efflux in both the fast and slow fraction remained either quite constant or showed some unpredictable, minor fluctuations. This was true for both Na(+) and the two sugars studied, confirming earlier conclusions that the steady levels of these solutes were not maintained by pumps. In all cases studied, the efflux curves showed at least two fractions. It is the fast-exchanging fraction that steadily and consistently increased in magnitude as the muscles were dying, until finally the concentration of solute in this fraction reached and sometimes surpassed the labelled solute concentrations in the original labelled solutions in which the muscles were equilibrated. The slow fractions showed only a transient increase or none at all. These observations show that it is the fast fraction that represents solute dissolved in cell water and rate-limited by passage through the cell surface and that the partial exclusion of Na(+) and the sugars have a unitary cause - a reduced solubility in the cell water which in the presence of ATP exists in the state of polarized multilayers.

19130 **(CONF-8108172—1-Draft) Use of purified enzymes in the standardization of enzyme assays.** Burtis, C.A. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007593.

From Annual scientific meeting of the Australian Institute of Medical Laboratory scientists; Melbourne, Australia (19 Aug 1981).

Purified enzymes are useful as reference material in the standardization of enzyme assays. They can be used to (1) develop and validate reference methods, (2) assess performance and transferability of reference methods on an interlaboratory basis, (3) assign target values to both calibrators and QC materials, and (4) assess performance of diagnostic products.

19131 **(LBL—17366) Photosynthate partitioning in higher plants. I. The effect of elevated carbon dioxide levels. II. The role of pyruvate kinase.** Baysdorfer, C.W. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 67p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009236.

Thesis.

The regulation of photosynthetic rates in a simulated alfalfa crop were investigated. Long and short term CO_2 enrichment, $^{14}CO_2$ feeding, and partial defoliation were used to investigate source/sink interactions in a simulated alfalfa crop. Long term CO_2 enrichment did not increase the photosynthetic rate or the growth rate in mature alfalfa, in spite of the fact that photorespiration was substantially reduced. Short term CO_2 exposures did, however, increase mature crop photosynthetic rates as did partial defoliation of the crop. In contrast, seedling photosynthetic rates and growth rates were increased in response to long term CO_2 enrichment. These results suggest that, for the mature alfalfa crop, photosynthesis is limited by the demand for photosynthate. In a second, related experiment partial purification of and regulatory properties of spinach pyruvate kinase isoforms were isolated. Pyruvate kinase from spinach (Spinacea oleracea L.) leaves consists of two isoforms, separable by blue agarose chromatography. Both isoforms share similar pH profiles and substrate and alternate nucleotide k/sub m/ values. In addition, both isoforms differ in their response to three key metabolites, citrate, aspartate, and glutamate. The first isoform is similar to previously reported plant pyruvate kinases in its sensitivity to citrate inhibition. The second isoform is not affected by citrate but is regulated by aspartate and glutamate. Aspartate is an activator with a K/sub a/ of 0.05 mM, glutamate an inhibitor with a K/sub i/ of 0.68 mM. A pyruvate kinase with these properties has not been previously reported. Based on these considerations it is likely that the activity of the first isoform is regulated by respiratory metabolism. The second isoform, in contrast, may be regulated by the demand for carbon skeletons for use in ammonia assimilation.

19132 **Folate-dependent enzymes in cultured Chinese hamster ovary cells: impaired mitochondrial serine hydroxymethyltransferase activity in two additional glycine-auxotroph complementation classes.** Taylor, R.T.; Hanna, M.L. (Univ. of California, Berkeley). *Archives of Biochemistry and Biophysics;* **217**: No. 2, 609-623(Sep 1982). Contract W-7405-ENG-48.

Two glycine-requiring Chinese hamster ovary (CHO) auxotrophs (GLYB and AUXB2) representative of the Gly^- mutant classes B and C are shown to have defects in folate metabolism. These defects result in 10-fold lower rates of whole cell L-[U-^{14}C]serine-to-[^{14}C]glycine conversion relative to the parental CHO lines (2 vs 20 nmol/h/10^6 cells). This restriction in serine hydroxymethyltransferase (SHMT) activity is localized in the mitochondria. Intact mitochondria from GLYB and AUXB2 convert labeled serine to glycine at 1-4% the rate and with only 1-3% of the total capacity of parental CHO mitochondria. Yet, GLYB and AUXB2 contain parental cell amounts of cytosolic and mitochondrial SHMT, the latter displaying normal substrate K/sub m/ values. The whole cell and mitochondrial impairments in glycine formation are corrected in GLYB (but not AUXB2) by a prior growth with 100 μM dl-folinate. They are also partially restored in spontaneous or chemically induced Gly^+ revertants of GLYB and AUXB2. Subcellular fractionation experiments suggest that a low content (one-fifth parental) of mitochondrial folylpolyglutamates contributes to the auxotrophy of GLYB. These studies demonstrate that mitochondrial SHMT is potentially functional in the Gly^- mutant classes B (GLYB) and C (AUXB2). The impaired SHMT activity in vivo and in isolated mitochondria may result from a deficiency in mitochondrial recycling of 5,10-methylenetetrahydrofolate back to tetrahydrofolate.

19133 **Effects of vitamins B_1, B_2, B_6 and C on erythrocyte enzymes in South African Bantu.** Yeh, J. (Dept. of Health, Education and Welfare); Hankes, L.; Oosthuysen, A.W. *Acta Vitaminologica et Enzymologica;* **4**: No. 4, 337-346(1982). Contract AC02-76CH00016.

Erythrocyte transketolase (ETK), glutathione reductase (EGR) and glutamate pyruvate transaminase (EGPT) enzyme activities and coenzyme effects (in vitro coenzyme stimulation) were studied in 30 random, 10 primary hepatoma, and 3 pellagrins natives from Mozambique. Twenty-nine subjects of the random group exhibited ETK coenzyme effects below 20%. Urinary thiamine levels in this group were in normal or high ranges. The primary hepatoma group had 4 with ETK coenzyme effects above 30%, and 3 of the 4 had low level urinary thiamine excretions. Of the three pellagra patients in the study, none showed biochemical vitamin B_1 deficiency. All primary hepatoma and 23 random natives had EGR coenzyme effects above 30%, but the daily urinary riboflavin excretions correlated with the coenzyme effects in only the random group. EGPT activites were spread over a wide range.

The random group with high EGPT activity showed a correlation with low coenzyme effect, while the primary hepatoma group did not exhibit this correlation. After 4-day single-vitamin treatment, vitamin B_1 increased total ETK and vitamin B_2 increased total EGR (after in vitro coenzyme saturation). Vitamin B_6 did not increase total EGPT. Vitamin B_2 was less effective on total EGR in primary hepatoma than in random subjects.

19134 **Structural effects on the circular dichroism of ethidium ion-nucleic acid complexes.** Dahl, K.S.; Pardi, A.; Tinoco, I. Jr. (Univ. of California, Berkeley). *Biochemistry;* **21**: 2730-2737(1982). Contract W-7405-ENG-48.

Binding of the frameshift mutagen ethidium bromide to eight dinucleoside phosphates of different complementary base sequences, to trinucleoside diphosphates with mismatched bases capable of forming bulged structures (CpUpG and GpUpG + CpC), and to calf thymus DNA at different counterion concentrations was studied by optical methods, notably UV-visible spectroscopy, circular dichroism (CD), and fluorescence-detected circular dichroism (FDCD). The ethidium ion intercalated between the base pairs of the minihelix formed by the complementary dimers and displaced the mismatched bases to form bulged structures with the trimers. The stoichiometry of the complexes was 2:1 oligonucleotide:dye (or 1:1:1 for non-self-complementary species). Equilibrium constants for complex formation showed a general preference for dye binding to complementary sequences. Above 300 nm, where only the dye absorbs light, the induced CD spectra of the complexes had bands at 510, 375, 330, and 307 nm, with the magnitude of the 307-nm band, per bound dye, being the largest and sequence dependent. The CD spectra down to 220 nm of some complexes were obtained by FDCD measurements; between 220 and 300 nm, both the positions and the magnitudes of the bands were sequence dependent. At very low ionic strength, complexes of calf thymus DNA plus ethidium ion in different salt concentrations showed that the 307-nm CD magnitude increased with decreasing counterion concentration. Implications of the results for theories of the induced CD spectrum of the ethidium ion are discussed.

19135 **Abilities of extracts of human lymphocytes to remove O^6-methylguanine from DNA.** Waldstein, E.A.; Cao, E.H.; Bender, M.A.; Setlow, R.B. (Brookhaven National Lab., Upton, NY). *Mutation Research;* **95**: 405-416(1982). Contract AC02-76CH00016.

O^6MeGua is a presumptive mutagenic and carcinogenic product in DNAs treated with methylating agents. The abilities of lymphocyte extracts from 34 apparently normal individuals to remove O^6MeGua from exogenous DNA have been measured. The activity in extracts is stable to freezing and so permits repeat determinations and hence high precision in the assays. The data on removal are consistent with the idea that the removal is accomplished by the transfer of a methyl group to a methyl-accepting protein and that the protein acts in a stoichiometric fashion. Extracts from lymphocytes stimulated with PHA show no increase as a result of PHA stimulation of cells. There are large variations in the abilities of human lymphocytes to remove O^6MeGua, but the differences are not correlated significantly with sex or age. Unstimulated lymphocytes show a bimodal distribution of removing activity, whereas stimulated ones show a predominant single peak of activity. Extracts of T lymphocytes are more proficient than those of B lymphocytes and of any other white cells.

19136 **Effects of glycine hydroxamate, carbon dioxide, and oxygen on photorespiratory carbon and nitrogen metabolism in spinach mesophyll cells.** Lawyer, A.L.; Cornwell, K.L.; Gee, S.L.; Bassham, J.A. (Univ. of California, Berkeley). *Plant Physiology;* **69**: 1136-1139(1982). Contract W-7405-ENG-48.

The effects of added glycine hydroxamate on the photosynthetic incorporation of $^{14}CO_2$ into metabolites by isolated mesophyll cells of spinach (Spinacia oleracea L.) was investigated under conditions favorable to photorespiratory (PR) metabolism (0.04% CO_2 and 20% O_2) and under conditions leading to nonphotorespiratory (NPR) metabolism (0.2% CO_2 and 2.7% O_2). Glycine hydroxamate (GH) is a competitive inhibitor of the photorespiratory conversion of glycine to serine, CO_2 and NH_4^+. During PR fixation, addition of the inhibitor increased glycine and decreased glutamine labeling. In contrast, labeling of glycine decreased under NPR conditions. This suggests that when the rate of glycolate synthesis is slow, the primary route of glycine synthesis is through serine rather than from glycolate. GH addition increased serine labeling under PR conditions but not under NPR conditions. This increase in serine labeling under PR conditions but not under NPR conditions. This increase in serine labeling at a time when glycine to serine conversion is partially blocked by the inhibitor may be due to serine accumulation via the "reverse" flow of photorespiraton from 3-P-glycerate to hydroxypyruvate when glycine levels are high. GH increased glyoxylate and decreased glycolate labeling. These observations are discussed with respect to possible glyoxylate feedback inhibition of photorespiration.

19137 **Concanavalin A alters the turnover rate of tyrosine aminotransferase in cultured hepatoma cells.** Donohue, T.M. Jr.; Lee, K.L.; Kenney, F.T. (Oak Ridge National Lab., TN). *Biochimica et Biophysica Acta;* **721**: 94-100(1982). Contract W-7405-ENG-26.

Concanavalin A added to monolayer cultures of Reuber H-35 hepatoma cells caused a rapid inactivation of tyrosine aminotransferase (L-tyrosine: 2-oxoglutarate aminotransferase, E.C. 2.6.1.5) and loss of reactivity with antibody against the native, dimeric enzyme. Analysis of treated cells with an antibody raised against carboxymethylated, denatured enzyme showed that the inactivated enzyme was reactive with this reagent, which does not react with the native enzyme. Subsequent addition of α-methyl-D-mannopyranoside to remove concanavalin A restored both enzyme activity and reactivity to antibody against native enzyme. After long-term treatment with concanavalin A, the restored enzyme levels were significantly higher than in controls treated with the sugar but not the lectin. Analysis of the turnover of the enzyme by two methods revealed that the rate of its degradation is reduced about 2-fold in concanavalin A-treated cells. Treatment with H-35 cells with concanavalin A thus effects an alteration in conformation of tyrosine aminotransferase, rendering it somewhat less sensitive to intracellular degradation.

5503 Cytology

REFER ALSO TO CITATION(S) 19132, 19136, 19137, 19148

19138 **Note on the distribution of ectopic thyroid tissue in five species of poeciliid fishes.** Woodhead, A.D.; Bryant, P.C. (Brookhaven National Lab., Upton, NY). *Journal of Fish Biology;* **21**: 59-62(1982).

The intraperitoneal injection of polycylic aromatic hydrocarbons in young Amazon mollies induces proliferation of ectopic thyroid tissue in the spleen. The authors have surveyed untreated mollies, Poecilia formosa, and four closely related poeciliid fishes to see if ectopic thyroid tissue occurs normally in the spleen. If this were the case, it is possible that the tissue may have been stimulated to proliferate by the injected compounds. We found no instances of ectopic thyroid at any site in 50 untreated Amazon mollies examined nor in some 50 spleens dissected from other untreated fish. Splenic thyroid tissue was found in five guppies from 50 surveyed, but did not occur in other species.

5504 Genetics

REFER ALSO TO CITATION(S) 19132, 19212, 19219

19139 **(DOE/EV/70007—T1) Repair of damaged DNA in-vivo. Comprehensive progress report, August 1980-August 1983.** Hanawalt, P.C. (Stanford Univ., CA (USA)). Jul 1983. Contract AT03-76EV70007. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84006020.

We have extended our characterization of long patch excision repair (LPER) and have demonstrated that LPER is not mutagenic (or error-prone); that the recA function is required for LPER, at least for its regulation; that the substrate for LPER is produced as a linear (not an exponential) function of uv (254 nm) dose; and that LPER can occur in uvr^- cells treated with N-methyl-N-nitro-N-nitrosoguanidine (MNNG). We have developed 3

methods for measuring the frequency of interstrand crosslinks in DNA and are now applying these methods to the study of the formation and repair of DNA crosslinks in E.Coli. We have developed a monoclonal antibody specific for thymine glycol in DNA, and are using it to study the repair of thymine glycol in E. coli.

19140 **Genetic effects of the flavonols quercetin, kaempferol, and galangin on Chinese hamster ovary cells in vitro.** Carver, J.H. (Lawrence Livermore National Lab., Livermore, CA); Carrano, A.V.; MacGregor, J.T. *Mutation Research;* **113**: 45-60(1983). Contract W-7405-ENG-48.

The genotoxicity of selected flavonols was evaluated by multiple endpoints in Chinese hamster ovary (CHO) cells. Chromosomal aberrations, sister-chromatid exchange (SCE), and forward mutation at 4 gene loci were measured in a single population of cells exposed to quercetin, kaempferol, or galangin for 15 h with and without metabolic activation. The incidence of chromosomal aberrations was significantly increased by quercetin in the absence of activation and by kaempferol and galangin with and without activation. Flavanol treatment affected SCE and mutation at the hgprt, aprt, or Na^+/K^+-ATPase loci only marginally, but significantly increased mutation frequencies at the tk locus. The response at the tk locus suggests that the CHO cells may behave similarly to L5178Y cells, in which the tk locus is thought to reflect chromosomal lesions in addition to point mutation. These results indicate that, at least under the conditions examined, flavonols induce chromosomal aberrations in CHO cells, but have little effect on point mutation or SCE.

19141 **Symmetry characteristics of the genetic code.** Findley, G.L. (New York Univ., New York); Findley, A.M.; McGlynn, S.P. *Proceedings of the National Academy of Sciences of the United States of America;* **79**: 7061-7065(Nov 1982). Contract AS05-76EV03018.

The symmetric pattern of codon degeneracies is discussed by using empirical arguments processed within a group-theoretic framework. It is reasoned that the genetic code is a relation rather than a mapping, and the symmetry of a relation defined on the codons is investigated. The principal results are: a new extraction of the basic symmetry inherent in the standard genetic code; the unification of the symmetry of ambiguous codon assignments with that of the standard genetic code; and the primacy of the concept of a biological context as that device which degenerates the code relation to a mapping.

19142 **Apomictic interspecific hybrids between pearl millet and Pennisetum orientale L.C.Rich.** Hanna, W.W.; Dujardin, M. (Univ. of Georgia, Tifton). *Crop Science;* **22**: 857-859(Jul 1982). Contract AS09-76EV00637.

Pearl millet, Pennisetum americanum (L.) Leeke, is an important world food and forage crop. Pennisetum orientale L.C. Rich. has genes for apomixis, perennial growth habit, pest resistance, and drought tolerance which could be used to improve pearl millet. The objectives of this research were to determine the cytotaxonomic relationship of these two species and to explore the feasibility of interspecific germplasm transfer. Five interspecific hybrids, 2n = 25, with 7 large P. americanum millet (A) and 18 small P. orientale (0) chromosomes were produced by pollinating cytoplasmic male sterile pearl millet with P. orientale pollen. Although the possibility of germplasm exchange existed, the two species appeared to be not closely related. Among three hybrids examined, one was a facultative apomict, one was an obligate apomict and another was highly apomictic with 3% of ovules with sexual embryo sacs. Sixteen backcross progenies were established from interspecific hybrids pollinated with pearl millet pollen. The balanced chromosome number for both species in these latter plants should provide a mechanism for restoring fertility in the interspecific hybrid thus enabling germplasm transfer. The interspecific hybrids were male sterile but set about 1% seed when pollinated with pearl millet pollen.

19143 **Genetic coding: approaches to theory construction.** Findley, A.M.; Findley, G.L.; McGlynn, S.P. (Louisiana State Univ., Baton Rouge). *Journal of Theoretical Biology;* **97**: 299-318(1982). Contract AS05-76EV03018.

A new approach to genetic coding theory, the generalized genetic code (GGC), is presented. It is shown how the GGC reunifies ambiguous codon assignments within the standard genetic code, thereby redefining genetic code universality in a modified form. An extensive survey of ambiguous codings (> 100 assignments) is presented as a critical test of the GGC and all assignments are successfully analyzed within the GGC. Finally, the operative nature of biological contexts is investigated and discussed.

19144 **Generalized genetic code. A note on order-isomorphism/order-equivalence relations.** Findley, A.M.; Findley, G.L. (Louisiana State Univ., Baton Rouge). *International Journal of Quantum Chemistry, Quantum Biology Symposium;* **9**: 59-63(1982). Contract AS05-76EV03018.

Constructive and combinatorial relationships between order-isomorphisms and order-equivalence classes within the generalized genetic code are presented, not only for the biologically relevant groups of order 4, but also for finite groups of arbitrary order. The main result is the derivation of the number (and types) or order-equivalence classes for a group of order n. Finally, an extension of this work to all biologically admissible alternative codes is discussed.

5505 Metabolism

REFER ALSO TO CITATION(S) 18338, 18875, 19129, 19192

19145 **(AD-A—135754/0) Biodisposition of organophosphates in mice and rats. Annual summary report No. 1, 1 August 1982-31 July 1983.** Martin, B.R. (Medical Coll. of Virginia, Richmond (USA). Dept. of Pharmacology). Aug 1983. 38p. NTIS, PC A03/MF A01.

The biodisposition of radioactivity was studied in mice following the i.v. administration ^{3}H-DFP (1 mg/kg). ^{3}H-DFP penetrated tissues rapidly so that within 1 min of drug administration, maximal levels of radioactivity were found in brain, lung, heart and kidney. The peak levels of radioactivity in liver, diaphragm and fat occured at 5 min. Tissue levels remained elevated for approximately 8 hr. The rank order of tissue concentrations during this period of time was liver > plasma > kidney > lung > heart = diaphragm > brain = fat. Radioactivity declined appreciably by 3 days, and after 7 days the highest concentrations were found in liver and lung with somewhat lower concentrations in kidney. It may be that lung and liver may be potential storage depots under certain circumstances. Radioactivity was readily extracted from brain homogenates (55% removed by ethyl acetate) 1 min after administration but the amount that was nonextractable increased with time. A relatively small portion (13-24%) of the radioactivity was extractable from the other tissues at the early time points but even these small precentages decreased with time. It appears that enzyme aging occurs slowly or to a limited degree in mice but further experimentation will be necessary to establish the extent to which it occurs.

19146 **(GKSS—83/E/44) Inhibition of fouling by animal growth - a study using wood constituents.** Shukla, S.K. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Kiel Univ. (Germany, F.R.). Fachbereich Mathematik-Naturwissenschaften). 1983. 88p. (In German). GKSS-Forschungszentrum Geesthacht, Geesthacht-Tesperhude (Germany, F.R.).

Inhibitory effects of constituents from Dalbergia retusa, Tectona grandis and Lophira procera heartwoods on fouling were studied in field and laboratory tests and compared with a copper paint. Lophira extract impaired fouling by barnacles and tubeworms, R-4 methoxydalbergione, obtusaquinone and lapachol didn't. Lapachol proved to be more effective than R-4 methoxydalbergione and obtusaquinone against Balanus improvisus in LD_{50}-tests. Maximum inhibition of ^{45}Ca and ^{14}C uptake in the shell of Balanus improvisus was caused by lapachol. The same trend was observed in studies on alkaline phosphatase of mantel.

19147 **Active proton pump of intact vacuoles isolated from Tulipa petals.** Wagner, G.J.; Lin, W. (Brookhaven National Lab., Upton, NY). *Biochimica et Biophysica Acta;* **689**: 261-266(1982).

Anthocyanin pigments within Tulipa petal vacuoles provide the means for real-time spectrophotometric monitoring of vacuolar sap pH and for studying ATP-dependent proton transport in isolated, intact vacuoles. Spectra of petal extracts were used to select empirically those wavelengths giving an approximately linear variation in anthocyanin absorbance with pH over a pH range of interest. A sensitive single-beam spectrophotometer with vertical optics was used to monitor absorbance changes of intact, settled vacuoles. Substrates and inhibitors of vacuolar ATPase were added to probe proton transport. Acidification of the vacuole sap occurred following addition of MgATP, but not CaATP. Proton accumulation was inhibited by 10 μM Dio 9, an inhibitor of tonoplast ATPase in vitro, and the proton gradient established by addition of MgATP was dissipated after addition of 10 μM CCCP. No pumping response was observed with intact protoplasts. Potential differences across the tonoplast were directly measured by impaling vacuoles with glass microelectrodes.

5506 Medicine

REFER ALSO TO CITATION(S) 19191

19148 **(AD-A—136160/9) Nuclear magnetic resonance relaxation and water contents in normal tissues and five types of cancer cells.** Ling, G.N.; Tucker, M. (Pennsylvania Hospital, Philadelphia (USA). Dept. of Molecular Biology). 1983. 30p. NTIS, PC A03/MF A01.

By studying NMR water proton spin lattice relaxation times (T1) of normal mouse and rat tissues at varying water contents and by comparing the data obtained with similar data obtained from 5 strains of pure cancer cells, we reached the conclusion that differences in total water contents between normal tissues and cancer cells contributes less than 10% to the differences between the longer T1 in cancer calls than in normal tissues. In spite of the diversity of the origins of the 5 strains of cancer cells studied (all in the ascites form) their T1 and T2 as well as water contents are confined to between relatively narrow limits, suggesting the physical state of water in all 'maximally deviated' cancer cells is very similar. In these 'pure' cancer cells studied, the spun-down cell pellet contains about 5% extracellular fluid (ecf). However by studying T1 and T2 with varying amount of ecf and by extrapolation to zero ecf, we obtained T1 and T2 of pure Ehrlich cancer cells without ecf. These values are close to values from cells with 5% ecf. Other studies indicate rapid exchange of water proton between the inside and outside of Ehrlich carcinoma cells.

19149 **(DOE/SF/00012—T24) Limitations of quantitative phase analysis for detection of coronary artery disease in patients with impaired LV-function.** Schwaiger, M.; Ratib, O.; Hanze, E.; Schelbert, H.R. (California Univ., Los Angeles (USA)). 1983. Contract AC03-76SF00012. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007322.

Portions are illegible in microfiche products.

Phase analysis of radionuclide ventriculograms is used for identifying ischemic wall motion abnormalities. Myocardial segments with an abnormal phase and the synchronicity of LV wall motion can be assessed from a histogram of LV phase distribution. We examined in this study the sensitivity of SDP-LV for identifying coronary artery disease and its specificity in patients with normal and various degrees of left ventricular impairment. A total of 84 patients were studied. In severe left ventricular impairment, phase analysis did not aid in distinguishing coronary artery disease from other causes of ventricular dysfunction. By contrast, phase analysis was highly sensitive and specific for coronary artery disease in patients with normal or moderately depressed left ventricular function.

19150 **(HRP—0904719/2) Planning for nuclear magnetic resonance services. Current health issues No. 2.** (Health Systems Agency of Southeastern Pennsylvania, Philadelphia (USA)). 23 Nov 1983. 20p. NTIS, PC A02/MF A01.

This document seeks to provide guidance in planning and in reviewing proposals for NMR services in the region, until a quantitative need assessment for those services can be developed. The Food and Drug Administration's determination that the diagnostic capabilities of NMR imaging have proven to provide substantial benefit vs. risk to patients proven by scientifically valid studies conducted by sponsors of investigational equipment at hospital sites, is pending. When the costs and benefits are clarified, then standards and criteria and a need assessment method, both on the institutional and regional levels, will be developed as an amendment to the Health Systems Plan.

19151 (KAERI/RR—360/82, pp 117-150) **Studies on radiation hazard.** Yun, T.K.; Kang, T.U.; Yun, Y.S.; Chung, I.Y.; Koh, J.W.; Kim, J.W.; Ryu, Y.W. (and others) (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A09/MF A01.

In Studies on maligmant cancer with sup(99m)Tc-labelled bleomycin.

Bleomycin (BLM), a group of the basic glycopeptide antibiotics with antitumor properties that is produced by a strain Streptomyces verticillus, is a chemotherapeutic agent known to concentrate highly in tumor cells. Therefore, the potential value of BLM labelled with sup(99m)Tc as a tumor-seeking agent was studied in tissues of rats and mice bearing Walker 256 carcinoma and Sarcoma 180 tumor cells. The optimal labelling procedure for BLM with sup(99m)Tc, using Sn(II) as the reductant are; pH value between 7.0 and 8.5 and Sn(II) concentration of 10^{-5} M. Bleomycin concentration has no influence and the chemical stability of the sup(99m)Tc complex is stable during 3 hours at room temperature. Under these conditions, approximately 90% of labelling was investigated by thin layer chromatographic analysis. Various organ distributions were observed after intravenous administration of the sup(99m)-BLM into Walker 256 carcinoma and Sarcoma 180 tumor bearing rats and mice after 1 hr, 3 hrs and 5 hrs.The concentration of Walker 256 carcinoma and Sarcoma 180 tumor by sup(99m)Tc-BLM was 0.2% and 0.5%, respectively, administrated activity after an hour. Tumor uptake of sup(99m)Tc-BLM was concentrated slightly more than all organs except kidney and blood.

19152 (KAERI/RR—360/82, pp 151-184) **Studies on radiation hazard.** Yun, T.K.; Kang, T.U.; Yun, Y.S.; Chung, I.Y.; Koh, J.W.; Kim, J.W.; Ryu, Y.W. (and others). 1983. (In Korean). NTIS (US Sales Only), PC A09/MF A01.

In Studies on the tumor chemotheraphy of sup(99m)Tc-labelled liposome and their uses.

The labelling yield percent of sup(99m)Tc-labelled liposomes and entrapment values (% of the drug used) for anticancer drugs entrapped in liposomes were measured to calculate by radioactivity through a Sephdex G-100 column. Also, depending upon the above obtained data, anticancer drug-liposomes (5-Fluorouracil, Ftorafur and Mitomycin-C etc.) were prepared. In animal experiments drugs to be entrapped in liposome in comparison with free drugs were administrated intraperitoneally to DBF_1 mice inoculated L1210 cells.

19153 **(LBL—17313) Kinetic analysis of dynamic PET data.** Knittel, B. (Lawrence Berkeley Lab., CA (USA)). Dec 1983. Contract AC03-76SF00098. 100p. NTIS, PC A05/MF A01; 1; GPO Dep. Order Number DE84008165.

Portions are illegible in microfiche products; Thesis.

Our goal is to quantify regional physiological processes such as blood flow and metabolism by means of tracer kinetic modeling and positron emission tomography (PET). Compartmental models are one way of characterizing the behavior of tracers in physiological systems. This paper describes a general method of estimating compartmental model rate constants from measurements of the concentration of tracers in blood and tissue, taken at multiple time intervals. A computer program which applies the method is described, and examples are shown for simulated and actual data acquired from the Donner 280-Crystal Positron Tomograph.

19154 **(PB—84-135664) Health equipment information, number 115, October 1983.** (Department of Health and Social Security, London (UK)). 1984. 19p. NTIS, PC E03/MF E03.

Contents: Squibb Surgicare Ltd: System 2-Stoma Bridge for loop ostomy; Electronic and medical equipment: guidance on documentation required for maintenance; Assessment of the radio-opacity of catheters; IEC Publication number 731: dosimeters with ionization chambers as used in radiotherapy; Seminar on digital radiolo-

gy; Economic appraisal of a Mobile CT Scanning Service; Equipment for the disabled; Evaluation of the Greiner G300 Analyser; Launch of Occupational Therapists' Reference Book 1983/4; Summary of health notices (hazard): 1 April 1983-31 August 1983; Safety Information Bulletin No 9-May 1983: Summary of items; Safety Information Bulletin No 10-July 1983: Summary of items; Safety Information Bulletin No 11-September 1983: Summary of items; Amendment to HEI 112 July 1983: evaluation of ECG Recorders.

19155 **Ramp injection of radiotracers for blood flow measurement by emission tomography.** Duncan, C.C.; Ment, L.R. (Yale Univ., New Haven, CT (USA). School of Medicine); Lambrecht, R.M.; Shiue, C.Y.; Bennet, G.W. (Brookhaven National Lab., Upton, NY (USA)); Rescigno, A. (Yale Univ., New Haven, CT (USA). School of Medicine; Brookhaven National Lab., Upton, NY (USA)). *Physics in Medicine and Biology;* **28**: No. 8, 963-972(Aug 1983).

A prototype instrument based on the coincidence detection of annihilation radiation was built to control the arterial concentration of a radionuclide as a uniformly increasing ramp function over a preset injection interval (ranging from 1.6 min to 13.6 h). The device was designed to accommodate radionuclides of different physical and biological half-life, and the physiological characteristics of the system being studied. A kinetic model based on the Kety-Schmidt integral was developed to permit the determination of cerebral blood flow (CBF). Both the kinetic model and the ramp injector were tested in cats studied with the PETT III positron emission tomograph and 4-(^{18}F)-fluoroantipyrine as the CBF tracer. The ratio lambda/f of the brain-to-blood partition coefficient (lambda) and blood flow (f) were determined simultaneously by serial measurements with positron emission tomography.

19156 **Radiation enhancement with ^{127}I-deoxyuridine.** Fairchild, R.G. (Brookhaven National Lab., Upton, NY). pp 299-300 of Synthesis and applications of isotopically labeled compounds. Duncan, W.P.; Susan, A.B. (eds.). Amsterdam, Netherlands; Elsevier Scientific Publishing Company (1983). (CONF-820666—). Contract AC02-76CH00016.

From International symposium on the synthesis and applications of isotopically labeled compounds; Kansas City, MO, USA (6 Jun 1982).

A technique for radiation enhancement of photon radiotherapy is outlined. High LET radiations in the form of Auger electron distributions are generated by photoactivation of stable iodine incorporated as iodinated deoxyuridine (IdUrd). Of the several halogenated deoxyribonucleosides evaluted, IdUrd was found to be the only thymidine (Tyd) analog providing effective photoactivation. This mechanism is combined with radiation sensitization to produce an overall radiation enhancement. Calculations show that 5% replacement of Tyd in tumor DNA should multiply the biological effectiveness of low energy photons by a factor of ~2. Higher replacements would provide higher gains. Enhancement results from chemical sensitization by IdUrd, where it is known that effects of irradition are multiplied by factors of from ~1.5 to 3 as replacement varies from 10 to 50%. Additional enhancement results from the stimulation of Auger cascades in DNA. Five percent replacement has been obtained in human tumor in vivo. Twice that has been obtained in murine tumors. Our data indicate that damage from photoactivation as well as chemical sensitization does not repair. Thus, it is anticipated that use of low dose rates associated with "permanent" implants of Sm-145 sources (38-45 KeV x-rays; T1/2 = 340 d) will yield an additional increase in therapeutic efficacy by a factor of from 3 to 8, compared to that obtained with acute dose rates.

19157 **Gold-195m, a new generator-produced short-lived radionuclide for sequential assessment of ventricular performance by first pass radionuclide angiocardiography.** Wackers, F.J.; Giles, R.W.; Hoffer, P.B.; Lange, R.C.; Berger, H.J.; Zaret, B.L. (Yale Univ. School of Medicine, New Haven, CT). *American Journal of Cardiology;* **50**: 89-94(Jul 1982). Contract AC02-78EV04625.

The feasibility of performing rapid sequential first pass radionuclide angiocardiography using a new short-lived radiotracer, gold-195m (^{195}/sup m/Au) half-life 30.5 seconds) was evaluated. This radionuclide emits a 262 keV gamma ray and is the daughter of mercury-195 (^{195}/sup m/Hg) (half-life 41.6 hours). The prototype table top ^{195}/sup m/Hg/^{195}/sup m/Au generator produced 20 to 25 mCi of ^{195}/sup m/Au in 2 ml of eluate (yield of 40 percent). Four dogs each had 15 to 20 sequential first pass studies performed with ^{195}/sup m/Hg at 3 to 10 minute intervals using a computerized multicrystal gamma camera. During the left ventricular phase, 160,000 to 190,000 counts/s were acquired. The end-diastolic left ventricular region of interest contained 3000 to 6000 counts (background- and decay-corrected). Multiple reproducible values for left ventricular ejection fraction were obtained during stable conditions. During infusion of isoproterenol, rapid increase of left ventricular ejection fraction was demonstrated. Excellent agreement was observed between studies performed with technetium-99m diethylenetriaminepentaacetic acid (^{99}/sup m/Tc-DTPA) and ^{195}/sup m/Au. This new short-lived radiotracer makes possible rapid sequential assessments of ventricular function at greatly reduced patient exposure to radiation.

19158 **Positron emission tomography of the brain.** Alavi, A. (Pennsylvania Univ., Philadelphia (USA). Dept. of Radiology); Reivich, M.; Greenberg, J.H. (Pennsylvania Univ., Philadelphia (USA). School of Medicine); Wolf, A.P. (Brookhaven National Lab., Upton, NY (USA)). pp 134-187 of Computed emission tomography. Ell, P.J. (London Univ. (UK)); Holman, B.L. (Harvard Medical School, Boston, MA (USA)) (eds.). Oxford, England; Oxford University Press (1982).

After a short historical introduction, this chapter concentrates on the use of positron emission tomography for functional studies of the brain which have resulted from the synthesis of [^{18}F 2-deoxy-2-fluoro-D-glucose] and similar ^{11}C and ^{14}C compounds, and the resulting quantifying of their regional uptake to determine the local metabolic rate for glucose in humans. The use of this technique for the following cerebral activation studies is discussed: auditory and visual stimulation, effects of stroke and seizure disorders on Local Cerebral Metabolism and perfusion, interictal and rictal findings, effects of aging and dementia and schizophrenia on Regional Metabolism. The following miscellaneous studies using positron emission tomography techniques are also mentioned: brain tumour, Huntington's disease, amino-acid and protein metabolism, and neuro-receptor localization studies using [^{11}C]-chlorpromazine. Extensive bibliography.

19159 **Ara-C cytokinetic studies in normal tissues in vivo.** Pallavicini, M.G.; Gray, J.W. (Lawrence Livermore National Lab., Univ. of California). *Medical and Pediatric Oncology;* **1**: 109-123(1982). Contract W-7405-ENG-48.

The importance of including normal tissues in the design of cytokinetic-based chemotherapeutic schedules is becoming increasingly apparent. However, the lack of rapid analytical techniques to obtain quantitative cytokinetic data on target subpopulations in heterogenous normal tissues, such as the gastrointestinal and hematopoietic system, has limited the inclusion of these tissues in therapy design. Once target subpopulations are identified and/or discriminated, flow cytometry in conjunction with radioactivity measurements by liquid scintillation counting can be used to rapidly obtain quantitative cytokinetic data during drug therapy. The present paper reviews our current cytokinetic techniques and the applications and limitations of these techniques in the analysis of Ara-C induced perturbations in the small intestine and hematopoetic system. Cell cycle information both prior to and 30 hrs following a single Ara-C treatment was obtained in the intestinal crypts and femoral marrow population using radioactive precursor uptake and flow cytometric techniques. In addition, the relationship between crypt cell survival and animal lethality following Ara-C treatment was determined to better understand the impact of a damage to a regenerative population on the "clinical endpoint" of animal survival. Understanding the principles behind the normal tissue toxicity which occurs during multidose treatment will hopefully allow modulation of this toxicity through the rational design of optimal chemotherapeutic schedules.

19160 **Use of Gallium-67 for detection of inflammatory diseases: a brief review of mechanisms and clinical applications.** Hoffer, P.B. (Yale Univ. School of Medicine, New Haven, CT). *International Journal of Nuclear Medicine and Biology;* 8: 243-247(1981). Contract AC02-78EV04625.

Gallium-67 localizes in inflammatory lesions by a variety of mechanisms including direct bacterial uptake, direct uptake by leukocytes, increased vessel permeability and fixation in tissue by iron binding proteins. Radiogallium imaging has proven useful in detecting infections in the lung, staging pulmonary inflammatory disease and distinguishing infarction from infection. It is useful in detecting intra-abdominal infections which are either diffuse or localized. It is a helpful adjunct to radiography and ^{99}/sup m/Tc-phosphate bone imaging in detecting bone and joint infections and is also useful in detection and differentiation of various renal infections.

5507 Microbiology

REFER ALSO TO CITATION(S) 18317

19161 **(PB—84-136423) Anaerobic corrosion by sulfate-reducing bacteria due to a highly-reactive volatile phosphorus compound. Final report.** Iverson, W.P.; Olson, G.J. (National Bureau of Standards, Washington, DC (USA)). 1983. 8p. Pub. in Proceedings of Conference on Microbial Corrosion Held at Teddington (England) on March 8-10, 1983, p46-53 1983.

Anaerobic corrosion by sulfate-reducing bacteria appears to be caused by a highly active volatile phosphorus compound, which reacts with bulk iron to form iron phosphide. Preliminary evidence also indicates that the phosphorus compound may also be produced by the direct action of bacterially produced hydrogen sulfide on inorganic phosphorus compounds. Accordingly, any organism that produces hydrogen sulfide, under anaerobic conditions, in the presence of certain phosphorus compounds should stimulate the anaerobic corrosion of iron, providing the iron does not have a film of iron sulfide present. In addition to formation of the phosphorus compound and the metabolic production of hydrogen sulfide by sulfate-reducing organisms, methylmercaptan and dimethyldisulfide are produced. These compounds were relatively non-corrosive to iron.

19162 **Accumulation of sediment-associated viruses in shellfish.** Landry, E.F. (Analytab Products, Inc., Plainview, NY); Vaughn, J.M.; Vicale, T.J.; Mann, R. *Applied and Environmental Microbiology;* 45: No. 1, 238-247(Jan 1983). Contract AC02-76CH00016.

The present study focused on the importance of contaminated sediments in shellfish accumulation of human viruses. Epifaunal (Crassostrea virginica) and infaunal (Mercenaria mercenaria) shellfish, placed on or in cores, were exposed to either resuspended or undisturbed sediments containing bound poliovirus type 1 (LSc 2ab). Consistent bioaccumulation by oysters (four of five trials) was only noted when sediment-bound viruses occurred in the water column. Virus accumulation was observed in a single instance where sediments remained in an undisturbed state. While the incidence of bioaccumulation was higher with resuspended rather than undisturbed contaminated sediment, the actual concentration of accumulated viruses was not significantly different from the accumulation of viruses from oysters residing on uninoculated sediments. When clams were exposed to undisturbed, virus-contaminated sediments, two of five shellfish pools yielded viral isolates. Bioaccumulation of undisturbed sediments by these bivalves was considered marginal when related to the concentration of virus in contaminated sediments; they would only represent a significant threat when suspended in the water column. Arguments were advanced for water-column sampling in the region of the water-sediment interface to provide an accurate determination of the virological quality of shellfish harvesting waters.

5509 Pathology

REFER ALSO TO CITATION(S) 19148

19163 **Mutagenicity of cigarette smoke in Drosophila melanogaster.** Kale, P.G.; Baum, J.W. (Brookhaven National Lab., Upton, NY). *Mutation Research;* 105: 149-156(1982). Contract AC02-76CH00016.

Mutagenicity of cigarette-smoke condensate has been reported in Salmonella, Neurospora, yeast, and, mammalian cells. Cigarette smoke itself is mutagenic in Salmonella and yeast, and causes mitotic abnormalities in Allium root tips. Preliminary studies in Drosophila indicated that cigarette smoke induced sex-linked recessive lethal mutations (SLRLS) in larvae, but the data are not available. This paper demonstrates that cigarette smoke does indeed induce SLRLs in larvae of Drosophila and that induction occurs in a specific germ-cell type, spermatocytes.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 19129, 19136

5520 Public Health

19164 (ZfI-Mitt—70, pp 128-139) **Aerosol ionization gas analysis for monitoring waste halothane in the atmosphere of operating theatre.** Schoentube, E. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Grosse, H.J. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

The aerosol ionization gas analysis has proved to be an excellent monitoring to detect traces of halothane in the air of operating theatres and to supervise the valid legal threshold limits for this substance in GDR and the required health protection measures.

19165 (ZfI-Mitt—70, pp 150-159) **Usability of radiation ionization detectors for the determination of N_2O concentrations in the air of operating theatres.** Popp, P.; Oppermann, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Schoentube, E. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)). Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

For the determination of N_2O concentrations in the air of operating theatres gas chromatography is particularly suitable, but it is necessary to use detectors, which render possible to determine both N_2O concentrations down to the ppb range and N_2O concentrations up to one hundred percent. Based on experimental results the usability of ionization cross-section detectors (CSD), electroncapture detectors (ECD) and noble gas ionization detectors (NGD) is examined. It was found that especially the ECD working at high temperatures is suitable for trace analysis (50 to 500 ppm) and the CSD for the detection of higher N_2O concentrations (100 ppm to 100%).

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 18638, 19142

19166 **(DOE/SR/00870—33) Interactions of subsoiling and sewage sludge on soil physical and chemical factors and growth of Pinus Taeda L. and a Festuca Sp. Progress report.** Berry, C.R. (Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development). 1984. Contract AI09-76SR00870. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007516.

Eight intensities of subsoiling were compared to disking on borrow pit reclamation plots amended with 17 mt/ha sewage sludge or inorganic fertilizer (1121 kg/ha) and lime (242 kg/ha). After one year, N and P levels in sludge plots were significantly higher than in fertilizer plots. K was low in all plots. Foliar N was significantly increased in trees on sludge plots, but foliar K was significantly higher in trees on fertilizer plots. Trees on the sludge-amended plots grew an average of 37.3% more in height and 76.5% more in DBH than trees grown in the fertilizer-amended plots.

19167 **(DOE/SR/00870—35) Survival and growth of seedlings of 10 half-sib families of loblolly pine with three ectomycorrhizal conditions on an upland site in South Carolina. Progress report.** Marx, D.H. (Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development). 1984. Contract AI09-76SR00870. 1p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008197.

Severe drought (1980 and 1981) induced variation precludes significance and conclusions. As reported in 1980, 1981, and 1982, drought caused excessive block to block variation in survival and growth and precluded possible effects of either pine genotype or ectomycorrhizal treatment. This study is closed with this report.

19168 **(DOE/SR/00870—36) Interaction of vam, sweetgum family, and root grade on plantation establishment. Progress report.** Kormanik, P.P. (Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development). 1984. Contract AI09-76SR00870. 1p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008177.

Second-year field data have been collected on survival, growth, and mycorrhizal development. Approximately 2500 root samples have been assayed for mycorrhizal development; 500 more are in the final stages of assay.

19169 **(DOE/SR/00870—37) Effects of root dips of benomyl and captan on seedling response and mycorrhizal development of outplanted longleaf, sand, and loblolly pines. Progress report.** Hatchell, G.E. (Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development). 1984. Contract AI09-76SR00870. 1p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008198.

The longleaf pine study evaluating the effects of root-stripping treatments, ectomycorrhizal condition, and seedling density in the nursery bed was terminated after collection of survival and growth data at the end of the second growing season. The striking effect of root stripping (simulating removal of short roots and ectomycorrhizae by lifting machines) that was reported after the first growing season was evident after the second growing season in terms of survival and root-collar diameters.

19170 **(DOE/SR/00870—38) Feasibility of growing hardwood species on a borrow pit amended with either fertilizer and lime or sewage sludge. Progress report.** Berry, C.R. (Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development). 1984. Contract AI09-76SR00870. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008199.

Previous research on other sites showed that 15 tons/A of dried sewage sludge followed by subsoiling is sufficient to promote rapid growth of pines and sweetgum on borrow pits. During the past year, data have been obtained from this experiment showing that 30 tons/A of sewage sludge, well incorporated and followed by subsoiling, will promote very rapid first-year growth of green ash, yellow poplar, sycamore, and sawtooth oak. Loblolly pine and sweetgum also grew well as in previous studies. In most cases, seedlings of these species grew significantly faster with sewage sludge than with 1000 lbs./Aof 10-10-10 fertilizer and 2 tons/A of lime. Yellow poplar and sycamore grew the faster of all species, attaining heights during the first growing season of 134 and 209 cms, respectively. Sweetgum, green ash, and sawtooth oak all attained heights over 100 cms.

19171 **(DOE/SR/00870—39) Effects of ectomycorrhizae removal on survival and growth of loblolly pine seedlings with pisolithus or natural ectomycorrhizae on an upland site in South Carolina. Progress report.** Marx, D.H. (Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development). 1984. Contract AI09-76SR00870. 2p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007879.

This study was undertaken to ascertain the significance of physiological stress caused by mechanical loss of specific ectomycorrhizae (as done by seedling lifting machines) to the capacity of pine seedlings to regenerate roots, survive, and grow.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 18783

19172 **(CNAEM-R—216) Effect of x-radiation on serum proteins.** Portakal, S. (Cekmece Nuclear Research and Training Center, Istanbul (Turkey)). 1982. 9p. (In Turkish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700093.

The inbred albine mice were exposed to 315 roentgen whole-body X-radiation at a rate of 22.5 roentgen per minute. Maximum decrease in the serum albumin and maximum increase in the serum globulin fractions were seen two hours after irradiation. Both of the serum proteins return to approximately normal levels within six hours.

19173 **(DOE/EP—0040/2) Radiation exposures for DOE and DOE contractor employees, 1982. Fifteenth annual report.** (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 57p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007946.

All Department of Energy (DOE) and DOE contractors are required to submit occupational exposure records to a central repository. The data required includes a summary of whole-body exposures to ionizing radiation, a summary of internal depositions of radioactive materials above specified limits, and occupational exposure reports for terminating employees. This report is a summary of the data submitted by DOE and DOE contractors for 1982. A total of 85,324 DOE and DOE contractor employees were monitored for whole-body ionizing radiation exposures in 1982. In addition to the employees, 87,262 visitors were monitored. Of all employees monitored, 57.4% received a dose equivalent that was less than measurable, 41.0% a measurable exposure less than 1 rem, and 1.6% an exposure greater than 1 rem. The exposure received by 86.5% of the visitors to DOE facilities was less than measurable. Only 13.5% of the visitors received a measurable exposure less than 1 rem, and < 0.01% of the visitors received an exposure greater than 1 rem. No employees or visitors received a dose equivalent greater than 5 rem.

19174 **(GSF-S—935) Fate of cesium, strontium, iodine and some transuranium elements in farm animals.** Mueller-Brunecker, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Nov 1982. 87p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750511.

Domestic animals may take up Cs, I, Sr and the most important transuranium elements by contaminated food, inhalation and

cutaneous resorption. The resorption takes place (with differing percentage distribution) via gastrointestinal tract, lungs, skin and with wounds via injured skin areas. With chronical exposure and after resorption of radionuclides a distribution balance develops in the blood; with a single incorporation the activity concentration in the blood one increases and decreases again. According to the affinity of the radionuclide its major part is transported to one particular organ or tissue system, where depending on the degree of specific activity the most different damages may be provoked. Considerable amounts of the radionuclide quantities are discharged with urine, feces or milk. The amount discharged into the milk is of particular radioecologic interest. The portion of the radionuclides, which is discharged into the muscles and the milk of animals for slaughter is indicated by transmission factors, which have to be subjected to revision. The transmission factors given in literature are classified according to the animal species and discussed in the corresponding chapters.

19175 **(GSI—83-3) In vitro effects of heavy ion beams on survival and growth of mammal cells.** Wulf, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.)). May 1983. 161p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84750514.

The effects of heavy ion beams on survival and growth of mammalian cell cultures was investigated in dependency on the order number ($Z >= 18$) and the particle energy (1.4 - 10 MeV/u). Cellular activation was determined with the colony formation test which led to an exponential reduction of the surviving units as function of particle flux. This result to be expected for closely ionizing radiation can be explained with a reduced biological repairing ability of the investigated cell-lines after heavy ion irradiation. In some cases of fractionated irradiation with heavy ions a damage intensification was found which could not be explained yet. Average inactivation - as the mean sensitive surface the cell presents to the heavy ion beam - was deduced from the inclination of the exponential survival curves. Since average inactivation is a scale of irradiation effectivity, average inactivation was investigated as equation of linear energy transfer, particle energy and tract extension. A linear dependency of average inactivation on particle energy and tract extension was found. Only with minor probability, the passage of a primary particle with only little tract extension provokes cellular inactivation so that increasing inactivation probability must be explained with increasing heavy ion energy due to the presence of released secondary electrones in the tract. In connection with the dependency of cellular inactivation on the tract extension, it was detected that the linear energy transfer of the individual particle types does not depend on the linear energy transfer.

19176 **(IKE—6-142) Model study of radiation effects on the gastrointestinal cell system.** Kicherer, G. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Mar 1983. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750256.

Since it is now possible to calculate the radiation fields used for medicinal purposes by means of radiation transport programs it was started to determine with mathematical models of radioeffects not only the physical effects or irradiation, but also the resulting biological radioresponses. This supplementary biologic information is not only of large general importance, but particularly valuable for the medicinal application of the biologically highly effective neutron radiation. With support by the Institute for Medicinal Radiophysics and Radiobiology of Essen University Hospital, and of two biomathematical working groups of Ulm University and Cologne University Hospital, who are experienced in the field of establishing mathematical models of the hematogenic cellular system, we developed out of experimental fundamental findings a cellkinetic, kybernetic model of the intestinal mucosa, which is highly sensitive to radiation. With this newly established model we succeeded for the first time in simulating comprehensively and quantitatively the time-dependent acute radioresponse of such a radiosensitive cellular system. For the first time we successfully used the computer simulation languages DARE-P and GASP, which are principally employed for solving problems in automatic control technology, and set up a radioresponse model.

19177 **(INIS-mf—8366) Supplement to the materials of part 26.** (Hessisches Ministerium fuer Wirtschaft und Technik, Wiesbaden (Germany, F.R.)). Mar 1980. 254p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE84780074.

The essential contents is a compilation and assessment of published data from all over the world with the intention of criticizing the current parameters for assessing the transfer of radionuclides from soil to plants, from food to meat and for absorption from the gastro-intestinal tract into the blood. Without considering the effects on the total chain of discharge/radiation exposure, the discussion of individual parameters as done here cannot bring about good results. The indicated ranges of variation of the transfer parameters do not have any influence on the total dose worth mentioning.

19178 **(KAERI/MR—37/82) Radionuclide analysis.** Park, C.K.; Yang, K.R.; Cho, Y.U.; Lee, M.H. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 55p. (In Korean). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700095.

To control and predict the internal contamination in the human body by radioactive materials, measurements of radionuclide in foodstuffs were carried out. These results can be monitored for the internal exposure of the general population and estimated the accumulation pattern of radioactive materials in the environment. In addition, measurements were made for both radioactivities and radionuclides of all environmental samples submitted from the nuclear power plants. The results in environmental samples collected from the nuclear power plants are especially necessary as the reference data between prior post-operation plants and as the reference data for use of quality control at the Kori power plant in operation.

19179 (KAERI/RR—360/82, pp 1-115) **Studies on radiation hazard.** Yun, T.K.; Kang, T.U.; Yun, Y.S.; Chung, I.Y.; Koh, J. W.; Kim, J.W.; Ryu, Y.W. (and others) (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. (In Korean). NTIS (US Sales Only), PC A09/MF A01.

In Studies on chronic effect on radiation.

This experiment was carried out to evaluate the chronic hazard of Co-60 low dose irradiation on ICR mice. There is now considerable evidence from human studies that age, both at exposure to radiation and at observation for risk, can be a major determinant of radiation induced cancer risk. For this reason, ICR mice at different ages as specified below were exposed to 60 m rads/week, 500 m rads/biweek of whole body Co-60 radiation at a dose rate of 3.6 rads/min. ICR mice were irradiated during pregnant period and each period from the 1st week to the 3rd week to the 52nd week, from the 6th week to the 52nd week and from the 22nd week to the 52nd week after the birth. All the experimental mice were autopsied immediately after sacrificed at the 52nd week. And all of their major organs were examined grossly and weighed. After fixation histo-pathological preparations were made for microscopical study. Blood cells-W.B.C., R.B.C., Hb-from eye's vein were counted by hemocytometer and hemometer.

19180 **(KAERI/RR—360/82) Studies on chronic effect on radiation.** (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 188p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE84780091.

Selected papers are indexed separately for inclusion in the database.

19181 **(KAERI/RR—371/82) Study on medical control of human radiation hazard. Effects of high dose irradiation on the leukocyte life span.** Kim, Y.K.; Koh, J.H.; Chung, I.Y.; Chae, S.H.; Shin, H.S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1983. 34p. (In Korean). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700094.

In case of occuring the atomic energy accident, the proper medical controls measure should be necessary but little is known till now. As a part of studies on acute effects of high dose irradiation the present report was carried out to evaluate the changes of

the leukocyte life span in the Newzealand white male rabbits by single whole body exposure to gamma rays from Cobalt 60 teleirradiation unit. The exposure was done in dose levels of 100, 300, 550 and 1000 rads to each experimental groups of 10 rabbits. The life span and apparent half survival time of leukocytes, and the elution rate of leukocytes in the circulating blood were measured by McMillan etc method using Chromium 51.

19182 **(ORNL/TM—8265) Estimating dose rates to organs as a function of age following internal exposure to radionuclides.** Leggett, R.W.; Eckerman, K.F.; Dunning, D.E. Jr.; Cristy, M.; Crawford-Brown, D.J.; Williams, L.R. (Oak Ridge National Lab., TN (USA)). Mar 1984. Contract W-7405-ENG-26. 138p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84008212.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

The AGEDOS methodology allows estimates of dose rates, as a function of age, to radiosensitive organs and tissues in the human body at arbitrary times during or after internal exposure to radioactive material. Presently there are few, if any, radionuclides for which sufficient metabolic information is available to allow full use of all features of the methodology. The intention has been to construct the methodology so that optimal information can be gained from a mixture of the limited amount of age-dependent, nuclide-specific data and the generally plentiful age-dependent physiological data now available. Moreover, an effort has been made to design the methodology so that constantly accumulating metabolic information can be incorporated with minimal alterations in the AGEDOS computer code. Some preliminary analyses performed by the authors, using the AGEDOS code in conjunction with age-dependent risk factors developed from the A-bomb survivor data and other studies, has indicated that the doses and subsequent risks of eventually experiencing radiogenic cancers may vary substantially with age for some exposure scenarios and may be relatively invariant with age for other scenarios. We believe that the AGEDOS methodology provides a convenient and efficient means for performing the internal dosimetry.

19183 **(PB—84-135318) Radiological impact of recycling plutonium in the fuel cycle of light water reactors (LWR): Professional staff exposure during normal operating periods.** White, I.F.; Kelly, G.N. (Commission of the European Communities, Luxembourg). 1984. 36p. (EUR—8189-FR). NTIS, PC E03/MF E03.

The radiological impact of the fuel cycle of light water reactors operated with enriched uranium may be altered through plutonium recycling. The impact on the population and on persons exposed professionally may show itself in different ways according to the different stages of the fuel cycle. The differing radiological impact on the different types of personnel involved in the fuel cycle is analyzed in the report. Each stage of the fuel cycle is studied separately (e.g. fuel fabrication, reactor operation, fuel reprocessing) as well as the transfer of radioactive material between the different stages. Taking the fuel cycle as a whole, it is estimated that in relation to a fuel cycle using enriched uranium, the recycling of plutonium involves a minimal increase in exposure to professional staff. (Copyright (c) CECA-CEE-CEEA, Bruxelles-Luxembourg 1982.)

19184 **(PB—84-135466) Comparative risks from fossil and uranium fuel cycles: a literature review. Research note.** Lautkaski, R. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1984. 83p. NTIS, PC A05/MF A01.

Some twenty comparative assessments of the health impacts of different sources of energy have been published since 1974. The method used in the studies is to estimate the number of deaths, diseases and injuries attributable to the production of a given amount of electric energy. However, this method involves a number of subtle methodical and conceptual problems. In this report these problems are reviewed to give an idea of how they are reflected in the assessed risk values for coal, oil and uranium fuel cycles.

19185 (ZfI-Mitt—70, pp 178-186) **Irradiation facility GBZ 81.** Doellstaedt, R.; Grahn, C.; Huebner, G.; Reinhardt, J.; Schulze, H.W.; Sprinz, H.; Winkler, E. Jun 1983. NTIS (US Sales Only), PC A24/MF A01. (CONF-8209165—Suppl.).

From 2. working meeting radioisotope application and radiation processing in industry; Leipzig, German D.R. (28 Sep 1982).

A gamma irradiation facility for the radiation treatment of feed, food and other products in bulk is presented. This facility permits the radiation treatment of onions, potatoes etc. in a continuous process. The radiation treatment of packed products is possible too. The construction of this facility, the transport system for the products, the transport system for the radiation sources and the radiation protection equipment are described.

19186 **Production of thymine base damage in ultrasound-exposed EMT6 mouse mammary sarcoma cells.** Dooley, D.A. (Univ. of Rochester, NY); Sacks, P.G.; Miller, M.W. *Radiation Research;* **97**: No. 1, 71-86(Jan 1984). Contract AC02-76EV03490.

Mouse mammary sarcoma cells, line EMT6/Ro, were exposed for 1 min to 1 MHz continuous wave ultrasound over a range of intensities from 0.5 to 30 W/cm^2 (spatial peak). The presence of thymine base damage (TBD) products of the 5,6-dihydroxydihydrothymine type was determined by an alkali degradation assay. Production of damage was found to be greatest at an intensity of 10 W/cm^2 and fell off rapidly above and below this intensity. The amount of base damage produced at 10 W/cm^2 ultrasound was approximately equivalent to the damage produced by a gamma-ray absorbed dose of 12 krad. Assay of cells immediately after sonication at 10 W/cm^2 showed that approximately 14% of the cells had been lysed. Tests showed that it was the DNA of the intact cells, however, which sustained all of the TBD. Survival data demonstrated that of the remaining unlysed cell population approximately 5% were viable, whereas cells exposed to 12 krad showed no survival. Additionally, cells were exposed for up to 5 min at 5 W/cm^2. An increase in TBD was demonstrated with increasing time of exposure such that the rate of production at 5 min was approximately three times greater than that of a 1-min exposure. TBD was found to be completely suppressed when cells were sonicated at 10 W/cm^2 for 2 min under 4 bar of hydrostatic pressure. Addition of the radical scavengers β-MEA and cystamine eliminated TBD but had minimal effect on survival.

19187 **Acidic extracellular environment reduces the fixation of radiation damage.** Freeman, M.L.; Sierra, E. (Columbia Univ. Coll. of Physicians and Surgeons, New York, NY). *Radiation Research;* **97**: No. 1, 154-161(Jan 1984). Contract AC02-78EV04733.

Chinese hamster ovary cells in exponential growth were irradiated with γ or X rays in an acidic or alkaline extracellular environment. Incubation in acid medium during or after irradiation reduced the degree of fixation of potentially lethal lesions. Fixation and repair of acid-modified damage occurred with a halftime of 9 to 10 min. The rate of repair of sublethal damage was unaffected by hydrogen ion concentration and progressed with a half-time of 30 min. An acid environment modified only survival of exponentially growing cells; unfed plateau-phase cultures were unaffected.

19188 **Tumor/normal tissue advantage for low dose rate neutron brachytherapy.** Maruyama, Y.; Feola, J.M.; Beach, J.L. (Univ. of Kentucky Medical Center, Lexington). *International Journal of Radiation Oncology, Biology and Physics;* **9**: No. 11, 1715-1721(Nov 1983).

Reports on clinical study of Cf-252 pelvic brachytherapy are reviewed and show that complication frequency is low. Los dose rate (LDR) neutron brachytherapy has been shown to be effective against cervical and advanced pelvic cancers; and produces 5 year cures without a high frequency of normal tissue complications. This is attributed to a high relative biological effectiveness (RBE) for the bulky, hypoxic tumor which along with an oxygen enhancement ratio (OER) advantage and dose-rate independent effects, produces rapid tumor regression and good local tumor control. Adjacent normal tissues which are oxygenated have lower RBE values than that of hypoxic tumors. Cf-252 brachytherapy increases the

dose differential, therapeutic gain and the probability of local tumor control, since the high RBE of Cf-252 for hypoxic tumor is much less in normal tissues. Cf-252 radiation concentrated in the tumor, and for this reason, has had much fewer attendant normal tissue complications compared to neutron beam therapy.

19189 **Induction of pyrimidine dimers and unscheduled DNA synthesis in cultured mouse epithelial cells exposed to 254-nm- and u.v.-B radiation.** Yotti, L.P.; Ley, R.D. (Oak Ridge National Lab., TN (USA)). *Carcinogenesis (New York);* **4**: No. 7, 923-925(1983).

Unscheduled DNA synthesis was induced in a dose responsive manner by two u.v. sources, a germicidal lamp (254nm) and an FS40 sunlamp (280-400nm). Using the endonuclease-sensitive site assay to detect pyrimidine dimer production and excision, the response of the newborn mouse cells to both u.v. sources was examined. The removal of pyrimidine dimers was not detected with either of the two sources of u.v. The speculation is made that primary, newborn mouse epidermal cells excise u.v.-induced pyrimidine dimers to an extent below the level of detection of the endonuclease-sensitive site assay but to an extent sufficient to induce unscheduled DNA synthesis.

19190 **Hepatic function in previously exposed thorium refinery workers as compared to normal controls from the health and nutrition survey.** Farid, I.; Conibear, S.A. (Argonne National Lab., IL). *Health Physics;* **44**: No. Sup. 1, 221-230(1983).

The effect of thorium exposure on hepatic function was investigated in 275 former workers of a thorium refinery. Body burden of radioactivity from the decay chain of thorium was measurred as ^{212}Bi and ^{220}Rn in the exhaled breath. Asparate aminotransferase, globulin and total bilirubin in sera were found to be associated with body burden of radioactivity at high levels of significance. Thorium-exposed workers were also compared with a population of white males from the Health and Nutrition Survey conducted by the National Center for Health Statistics from 1971 to 1975. The results showed the means of aspartate aminotransferase and alkaline phosphatase activities to be significantly higher ($P = 0.0001$) in the thorium-exposed workers when corrected for age, alcohol use and weight. The changes observed in liver function may be compatible with a toxic effect of thorium or daughter products on hepatocytes. The correlation of some hepatic function tests with body burden of radioactivity suggests a radiation effect of thorium although a chemical toxic effect cannot be ruled out and further investigation of chemical toxicity of rare earths are indicated.

19191 **Clinical problems in radiotherapy of carcinoma of the pancreas.** Castro, J.R.; Saunders, W.M.; Quivey, J.M.; Chen, G.T.; Collier, J.M.; Woodruff, K.H.; Lyman, J.T.; Twomey, P.; Frey, C.; Phillips, T.L. (Univ. of California School of Medicine, San Francisco). *American Journal of Clinical Oncology;* **5**: 579-587(1982). Contract W-7405-ENG-48.

Since 1975, 94 patients with localized unresectable carcinoma of the pancreas have been irradiated using helium and heavier particles at the University of California Lawrence Berkeley Laboratory. Despite surgical exploration and an extensive diagnostic workup including radiological, nuclear medicine, and computer-assisted tomographic studies, many patients proved to have occult liver metastases manifested within 9 months post treatment. In addition, local and regional control of the primary neoplasm (~20%) has been difficult to obtain even with doses of 6000 equivalent rad in 7 1/2 weeks. Gastric and biliary obstruction have required surgical bypass procedures since irradiation has not been successful in relieving obstructive symptoms. Evidence of gastrointestinal injury has been present in postradiation therapy in approximately 10% of patients, a figure which might be higher if more patients had a longer survival (average 10 months). Some patients require pancreatic enzyme supplementation because of pancreatic deficiency either secondary to tumor or treatment.

19192 **Distribution of ^{13}N in rat tissues following intravenous administration of nitroso-labeled BCNU.** Freed, B.R. (Memorial Sloan-Kettering Cancer Center, New York, NY); McQuinn, R.L.; Tilbury, R.S.; Digenis, G.A. *Cancer Chemotherapy and Pharmacology;* **10**: 16-21(1982).

The concentrations of label in 16 major organs and tissues of pentobarbital-sedated normal male rats were measured at six time points ranging from 0.2 to 50 min after IV injection of the antitumor drug BCNU labeled in the nitroso position with cyclotron-produced nitrogen-13. Initial (12-s) concentrations in the lungs, kidneys, and heart were 41, 13, and 11 times the whole-body average, respectively. Time for clearance of the first 50% of the injected dose from the circulation was of the order of several seconds. Estimated first-pass extractions of 70% or more were noted in the heart, kidneys, brain, stomach, small intestine, muscle, fat, and bone. Washout of label from the heart and lungs was quite rapid, removing most of the initially extracted ^{13}N from these organs by 2 min after injection. Label concentrations in the kidneys exceeded those in all other tissues studied between 2 and 50 min. Secondary accumulations of ^{13}N were observed in muscle, skin, liver, small intestine, and fat. Label concentrations in a number of tissues closely paralleled the steadily decreasing concentration in blood for various intervals between 5 and 50 min. The results suggest that the toxic insult to lung tissue from IV administered BCNU is effected in a period of several minutes. They also suggest that intra-arterial administration of the drug would significantly raise the target/nontarget dose ratio and lower the incidence of pulmonary toxicity.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 19121

19193 **(PB—84-138262) Acute and chronic temperature stress on copepod individuals and populations. Final report, November 1977-February 1983.** Bradley, B.P. (Maryland Univ., Baltimore (USA)). Oct 1983. 58p. NTIS, PC A04/MF A01.

Temperature variation resulting from thermal discharges of two power plants affected temperature tolerances and densities of two copepod species, Eurytemora affinis and Acartia tonsa. Temperature tolerances were increased genetically (next generation) provided either ambient temperature or delta T was sufficiently high. Densities also varied with temperature but not always systematically. Other criteria used to assess the environmental influence of power plant were egg production and potentials for physiological and genetic adaptation.

19194 **Responses of attached algal communities to termination of thermal pollution.** Wilde, E.W. (E.I. du Pont de Nemours and Co., Aiken, SC). *Hydrobiologia;* **94**: 135-138(1982). Contract AC09-76SR00001.

Post-thermal recovery of attached algae in six artificial streams subjected to three years of thermal pollution was studied for 20 months. Vaucheria, which had been reduced or eliminated by elevated temperatures in some of the streams, returned to pre-thermal abundance within one month. Schizothrix, which had been greatly augmented by heating, decreased to pre-thermal abundance within two months. However, Schizothrix also demonstrated a decreasing tendency to reappear during the late summer at above normal levels, in the stream previously heated the most (12.5°C). The epilithic red algae, Rhodochorton and Tuomeya were absent for three years in the stream heated 12.5°C above ambient, but returned to pre-thermal levels in three and five months, respectively, when the heating was terminated. 2 figures. 2 tables.

19195 **Temperature effect on growth rates of Eriophorum vaginatum roots.** Ellis, B.A.; Kummerow, J. (San Diego State Univ., CA). *Oecologia;* **54**: 136-137(1982).

Root growth rates of the sedge Eriophorum vaginatum L. were studied under controlled environmental conditions. The air temperature was maintained constant at 15°C while the root temperatures varied in 5°C intervals between 2° and 37°C (12°C excluded). Root growth rates of 1.2mm d^{-1} at 2°, 20.4mm d^{-1} at 32°C and 10.1mm d^{-1} at 37°C were recorded. A Q_{10} of 3.2 was calculated for the temperature range from 7° to 27°C. Root growth rates at temperatures above 17°C declined after one week of growth. The degree of decline was proportional to the applied root temperature. Depletion of available nonstructural carbohydrate was the probable cause for this decline.

19196 **Effects of elevated water temperature on the critical swim speeds of yearling rainbow trout, Salmo gairdneri.** Schneider, M.J. (Northwest Power Planning Council, Portland, OR); Connors, T.J. *Journal of Thermal Biology;* 7: 227-229(1982). Contract AC06-76RL01830.

Effects of elevated water temperature on the critical swim speeds of rainbow trout, Salmo gairdneri, were investigated. Trout acclimated to 10°C were exposed to 10, 15, 20 and 25°C while swimming and at rest. Initial swim speed of 20 cm s^{-1} was increased in 10 cm s^{-1} increments every 20 min until the fish fatigued. Critical swim speeds were calculated in absolute values (cm s^{-1}) and relative performance values (body lengths s^{-1}). Critical swim speeds were similar at 10, 15 and 20°C. Swimming performance was significantly decreased at 25°C. Performance measured as critical swim speed was unaffected by temperature elevations up to 10°C above acclimation temperature of 10°C. 1 figure.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 18040, 19044, 19135, 19138, 19184

19197 **(AD-B—070947/7) Development of candidate chemical simulant list: the evaluation of candidate chemical simulants which may be used in chemically hazardous operations. Final report 15 Jun-15 Dec 82.** (Little (Arthur D.), Inc., Cambridge, MA (USA)). Dec 1982. 144p. (ADL—87638-01). NTIS, PC A07/MF A01.

The objectives of this task were threefold: (1) to provide additional data for the proposed candidate simulates dipentene, methyl benzoate and benzyl alcohol by means of in-depth literature searches encompassing both computerized data bases and a manual search of the older literature; (2) to fully evaluate twelve possible candidate simulants under more flexible simulant criteria; and (3) to develop a list of candidate simulants in the low and non-volatile categories. Computerized literature searches were conducted for the twelve possible candidate simulants under more flexible intake simulant criteria as well as for dimethyl methylphosphonate, a compound selected for evaluation by the USAF. The twelve possible candidates included: cyclohexanone, n-dodecanethiol, methyl salicylate, dihexyl ether, dypnone, n-aminopropyl morpholine, n-(2-hydroxyethyl) morpholine, butyl salicylate, di(2-ethyl hexyl) ether, 2-undecanol, 2-hydroxyethyl-n-octyl sulfide and n,n-diethyl-m-toluamide. Full assessments of the potential health hazards associated with exposure to n-dodecanethiol, methyl salicylate, butyl salicylate and n,n-diethyl-m-toluamide were completed. All of these compounds meet the majority of USAF criteria for candidate simulants. Cyclohexanone was disqualified for reasons of toxicity, while the available toxicological data for the seven remaining candidates were considered inadequate for full assessment of hazard.

19198 **(BNL—34209) Benzalkonium chloride. Health hazard evaluation report.** Bernholc, N.M. (Brookhaven National Lab., Upton, NY (USA)). Jan 1984. Contract AC02-76CH00016. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008058.

Health hazards associated with the use of benzalkonium chlorides (BAC) are reviewed. Benzalkonium chloride is extensively used as a cationic disinfectant. It is found in a great many over-the-counter and prescription eye products, disinfectants, shampoos, and deodorants, and is used in concentrations that range from 0.001 to 0.01% in eyedrops, up to 2.5% in concentrated liquid disinfectants. Solutions of 0.03 to 0.04% BAC may cause temporary eye irritation in humans but are unlikely to cause any skin response except in persons allergic to quaternary ammonium compounds. Inhalation of a vaporized 10% solution of BAC produced a bronchospasmodic reaction in a previously sensitized individual. At present no other human health effects from BAC have been documented or inferred from exposure to such dilute concentrations.

19199 **(BNL—51745) Biological effects summary report: polyethylene glycol.** Silverstein, B.D.; Furcinitti, P.S.; Cameron, W.A.; Brower, J.E.; White, O. Jr. (Brookhaven National Lab., Upton, NY (USA)). Jan 1984. Contract AC02-76CH00016. 27p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007984.

An evaluation of the health effects of polyethylene glycol (PEG) was made to assess its potential use as a substitute for di(2-ethylhexyl) phthalate, which is used as test aerosol in quantitative fit testing of respirators. The polyethylene glycols of primary interest are those whose average molecular weights are between 200 and 600. PEG has a very low acute and chronic toxicity in animals. Toxic effects to the kidney resulting from high doses have been observed in laboratory animals and in burn patients whose injured skin was treated topically with PEG. It is unlikely that healthy people exposed to test aerosols of PEG would encounter such risks particularly at such low concentrations. No significant adverse effects from PEG have been observed in inhalation toxicology studies, carcinogen testing, or mutagen assays. Since the PEGs present no significant health hazard in the workplace, only a nuisance dust exposure limit of 10 mg/m^3 for total dust and 5 mg/m^3 for respirable dust is recommended. No standard for protection of human health is deemed warranted at this time. Therefore, PEG 400 may be used safely for quantitative fit testing of respirators without concern for adverse effects in healthy subjects.

19200 **(DOE/EV/04580—T2) Mechanisms and functional morphology associated with metal transport in Mercenaria mercenaria (Bivalvia:Mollusca).** Robinson, W.E.; Morse, M.P. (New England Aquarium Corp., Boston, MA (USA). Edgerton Research Lab.; Northeastern Univ., Boston, MA (USA). Marine Science Lab.). 20 Feb 1984. Contract AC02-77EV04580. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007950.

Studies on the morphological and physiological effects of environmental pollutants on both adult and larval marine bivalve molluscs are described. We have established a substantial data base on metals accumulation within individual organs of the quahog, Mercenaria mercenaria. In addition, studies on the transport, detoxification and elimination of cadmium and silver in this important species are reported. We have shown that various components of marine oilwell drilling muds can have deleterious effects on both adult sea scallops, Placopecten magellanicus, and surf clams, Spisula solidissima. For example, both Q-broxin and attapulgite clay, at concentrations as low as 100 mg l^{-1}, effected both the integrity of the sea scallop pseudolamellibranch gill and the rate of gill frontal ciliary activity.

19201 **(GSF-S—870) Epidemiological analysis of records about malformations of newborn in the land of Baden-Wuerttemberg.** Paretzke, H.G.; Merkle, W.; Schindel, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Sep 1982. 66p. (In German). Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz.

This GSF report is an epidemiologic analysis of records about malformations found in babies born in Baden-Wuerttemberg, i.e. an analysis of informative data and of possible endogenic factors of the supervisory system. This investigation led to two results: The comparison of the presently available data (being similar to those data obtained in the other countries of the Federal Republic of Germany) with data resulting from clinical studies and coming from other states with strict duty of notification showed that the rate of malformations clearly recognizable sub partu is approx. 2 to 4%. However, the rates of malformations statistically notified in the German Federal States at present range only around approx. 0,3%. Therefore it is pointed out that with orderly notification large regional or temporal increases of the reported malformation rates have to be expected. On the other hand the pesently available data of sensitive epidemiologic investigations are completely useless. Therefore it is urgently recommended to develop measures which will help to improve the bad situation as soon as possible. The second result is that Steinhilber-Schwab and colleagues made severe epidemiologic faults when they analyzed their data. Neither their statistical analytical method nor their resulting conclusions are scientifically correct. As the complete set of data shows, the malformation rates reported for the two observed rural districts do not present any particular findings. The majority of the rates established for the years before and after 1976 even range below the median calculated for the Federal Country Baden-Wuerttemberg. Consequently, further discussions about possible reasons for statisti-

cal particularities which did not really occur are no longer valid also because of statistical reasons.

19202 **(NP—4770169) Optimizing the use of biological indicators for detection of significant pollutant types.** Zimmermann, R.D. (Giessen Univ. (Germany, F.R.). Fachbereich Biologie). 14 Apr 1982. 166p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770169.

Bioindication methods to determine the different pollutant types have been compared using the accumulation indicators Halian ryegrass (cloned material) and pine (Picea abies) and the sensitive indicator species tobacco (Nicotiana tabacum), gladiolus (G. hybridus), tulip (T. gesneriana), leek (A. porrum), clover (T. pratense), alfalfa (M. sativa), spinach (S. oleracea), petunia (P. hybrida), pelargonium (P. zonale), French marigold (T. patula), salvia (S. splendens) and ipomoea (I. purpurea). Field tests were carried out on 15 different sites in Bavaria. By means of the accumulation indicators, inorganic pollutants (S, F, Cl, Pb, Cd, Zn) were to be determined by analyses of the plant material. In the sensitive indicator plants, growth and flowering were studied with regard to external damage. In tobacco plants, also the physiological parameters and the total nitrogen concentration were determined. The following recommendations can be made for region with unknown pollutant levels: Accumulation indicators can be used in large areas; they yield valid information in case of high pollutant levels and react in a highly differentiated manner to site-specific pollutant levels already within the normal concentration range. Sensitive indicators are of use only in the direct vicinity of large-scale pollution sources. They have a signal function and may warn of high air pollution levels.

19203 **(NP—4770206) Zonation, biomass, energy content, and heavy metal accumulation of marine algae from Chile, Helgoland and Spain.** Westermeier Hitschfeld, R.C. (Giessen Univ. (Germany, F.R.). Fachbereich Biologie). 14 Apr 1982. 151p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE84770206.

173 species of algae were identified in the areas of investigation. 57.2% of these algae were rhodophytes, 25.4% phaeophytes and 17.3% chlorophytes. Only 7 species, i.e. 4.0%, were found in all three regions. Brown algae were abundant in the surf zone. The average yield per year of biomass is a function of the season rather than the geographic latitude. Algae production is reduced by an: thropogenic effects, e.g. uncontrolled harvesting of algae on the coast of Chile. The energy content of the algae was between 2100 and 3300 cal/g of ash-containing dry matter and between 3100 and 4100 cal/g of organic dry matter. The high energy content was correlated with a low ash concentration. In the analyses, rhodophytes were the group highest in carbohydrates, followed by chlorophytes and phaeophytes. Protein concentrations were high especially in high-productivity periods and were found to be seasonal in some species. The heavy metal accumulation rate differed between species in one site. They are assumed to be a function of species and plant age. Pb, Cd and Zn concentrations of the algae were below the toxicity thresholds set in the relevant publications.

19204 **(PB—84-139781) Measurements of the static electrification of airborne dusts in workplaces.** Vincent, J.H.; Johnston, A.M.; Jones, A.D.; McLachlan, C.Q. (Institute of Occupational Medicine, Edinburgh (UK)). Sep 1983. 122p. (TM—83/15). NTIS, PC E07/MF E07.

The project described in this report was based on the need to obtain information about the static electrification of airborne dusts in workplaces so that any effects on the lung uptake of exposed individuals, on dust filtration and sampling and on other matters relevant to industrial hygiene could be assessed.

19205 **(UCRL—87651) Mutagens in cooked foods - metabolism and genetic toxicity.** Felton, J.S.; Bjeldanes, L.F.; Hatch, F.T. (Lawrence Livermore National Lab., CA (USA)). 17 Feb 1984. Contract W-7405-ENG-48. 14p. (CONF-8210253—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007784.

From Pacific conference on chemistry and spectroscopy; San Francisco, CA, USA (27 Oct 1982).

Portions are illegible in microfiche products.

Recently developed in our laboratories is an efficient extraction procedure incorporating XAD resin adsorption which yields from 200°C grilled ground beef an extract containing 230 Salmonella TA1538 revertants per g fresh weight of original ground beef. These mutagenic components are specific for frameshift-sensitive Salmonella strains and have an absolute requirement for metabolic activation. Normal-phase HPLC separation of methanol-extractable metabolites generated from reaction of 2-amino-3-methylimidazo [4,5-f]quinoline (IQ), a mutagenic component of broiled food with rat liver microsomes resulted in one direct-acting mutagenic peak and a second more polar peak still requiring metabolic activation. Two potent thermally-produced bacterial mutagens, 3-amino-1-methyl-5H-pyrido [4,3-b] indole (Trp-P-2) and IQ, were examined in mammalian cells. In excision repair-deficient CHO cells, Trp-P-2 exposure caused cytotoxicity, mutagenicity, sister chromatid exchange, and chromosomal aberrations at concentrations more than 30-fold lower than those for IQ. In normal repair-proficient CHO cells Trp-P-2 was one-half as active and IQ was inactive. Relative to Trp-P-2, IQ is much more potent in the Salmonella bacterial system than in mammalian CHO cells.

19206 **(UCRL—88226) Somatic mutations detected by immunofluorescence and flow cytometry.** Jensen, R.H.; Bigbee, W.; Branscomb, E.W. (Lawrence Livermore National Lab., CA (USA)). 26 Jan 1983. Contract W-7405-ENG-48. 27p. (CONF-8210110—4). NTIS, PC A03/MF A01. Order Number DE83007350.

From International symposium on biological dosimetry; Neuherberg, F.R. Germany (14 Oct 1982).

We conclude that we have at hand the tools for development of both a single amino acid substitution and a gene loss type assay for somatic cell mutations in human red cells. We are close to being able to assess these assays as possible means for screening the human population for individuals who may be at risk of acquiring abnormally high frequencies of mutant cells. The cause for such a high frequency of mutant cells could be a prior exposure of the individual to large amount of mutagen, or it could indicate a member of a vulnerable subpopulation that may have poor DNA repair systems. Either of these cases could well be an indication that the particular individual is at high risk that exposure to mutagens could lead to potential pathology. In the near future we expect to determine the reliability of the assays and to perform experiments to confirm the validity of flow cytometry in measuring real somatic mutagenic events that occur in vivo.

19207 **(UCRL—89398) Biological dosimetry of sperm analyzed by conventional methods: cautions and opportunities.** Gledhill, B.L. (Lawrence Livermore National Lab., CA (USA)). 23 Jun 1983. Contract W-7405-ENG-48. 25p. (CONF-831002—2). NTIS, PC A02/MF A01. Order Number DE83014449.

From International symposium on biological dosimetry, approaches to mammalian systems; Nueherberg, F.R. Germany (14 Oct 1983).

The objective of this article is to review the dynamic processes leading to the formation of mammalian sperm, to illustrate how some reproductive disorders affect semen quality, to summarize some of the more pertinent dosimetric applications of conventional (not automated cytologic) semen assays and to point out significant differences in species characteristics that can influence hazard evaluation based on changes in semen quality.

19208 **(UCRL—89431) Biological dosimetry of mutagenesis: principles, methods and cytometric prospects.** Mendelsohn, M.L. (Lawrence Livermore National Lab., CA (USA)). 23 Jun 1983. Contract W-7405-ENG-48. 19p. (CONF-831002—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE83014871.

From International symposium on biological dosimetry, approaches to mammalian systems; Nueherberg, F.R. Germany (14 Oct 1983).

It is the purpose of this overview to show briefly how mutation is thought to occur, how mutations and related events are currently detected, and where there may be targets of opportunity for

cytometric automation leading to improved biologic dosimetry of mutagenesis in the human and other species.

19209 **Liquid paraffins in feed enhance fecal excretion of mirex and DDE from body stores of lactating goats and cows.** Rozman, K.; Rozman, T.; Smith, G.S. *Bulletin of Environmental Contamination and Toxicology;* **32**: No. 1, 27-36(Jan 1984). Contract AS04-76ET33626.

Contamination of livestock with halogenated hydrocarbons has caused large economic losses in the past; not so much because of acute toxicity to animals but mainly because their high lipid solubility is frequently accompanied by low biodegradation resulting in prolonged half-lives. Liquid paraffins administered in the feed were shown to promote removal of lipophilic pesticides to the diet enhanced fecal elimination of hexachlorobenzene from body stores in rats and rhesus monkeys by ehnancing excretion with feces. Addition of white mineral oil or n-hexadecane from body stores of growing lambs without adverse effects on feed intake or diet digestibility. This study examined effects of liquid paraffins added to the feed on the disposition of ^{14}C-mirex in lactating goats under laboratory conditions and effects of white mineral oil in the feed on levels of DDE in body fat, milk and feces of dairy cattle in a field trail.

19210 **Microcomputer program for analyzing Ames test data.** Moore, D.; Felton, J.S. (Lawrence Livermore National Lab., Univ. of California). *Mutation Research;* **119**: 95-102(1983). Contract W-7405-ENG-48.

Several methods, designed for analyzing results from the Ames/Salmonella Mutagen Assay, are discussed and compared. In most applications, when there are few replicate measurements made, data are insufficient to distinguish among the models. Therefore a simple linear model is proposed and described, which is based on simple least-squares linear regression. This greatly simplifies estimation of the model parameters since only one iteration is required while all other methods require several iterations. This means that the method can be efficiently programmed to run on a microcomputer. Thus, data analysis can be more readily available to the many small laboratories using the Ames/Salmonella test. The fitting program is interactive and has graphical display enabling the user to decide for himself which points to include and whether or not the linear fit is acceptable. Use of this user-oriented, least-squares linear regression program will allow better quantitative comparison of Ames/Salmonella test results between laboratories and more quantitative decisions on when to repeat experiments at lower doses because of excess toxicity at doses tested.

19211 **Lung as a site of toxicological interactions.** Witschi, H.P.; Hakkinen, P.J. (Oak Ridge National Lab., TN). *Trends in Pharmacological Sciences;* **3**: No. 8, 333-335(Aug 1982). Contract W-7405-ENG-26.

Toxicological interactions may modify the biological response when exposure to two chemicals is simultaneous and the agents have the potential to react directly with each other. To analyze the response of the respiratory tract to multichemical exposure is particularly challenging. The conducting airways and the deep lung tissue may not only become exposed to a mixture of several chemicals in the inspired air, but toxicologically significant interactions may also occur if the lung is exposed to one agent through the airways and to a second one carried into the lung via the bloodstream. In this paper, the authors illustrate, with selected examples, how interactions between chemicals may produce acute or chronic lung disease.

19212 **Sister chromatid exchange and gene mutation.** Carrano, A.V.; Thompson, L.H. (Lawrence Livermore National Lab., CA). *Cytogenetics and Cell Genetics;* **33**: 57-61(1982). Contract W-7405-ENG-48.

The parallel induction of sister chromatid exchange (SCE) and single-gene mutation was quantified in Chinese hamster ovary cells following exposure to nine different physical or chemical agents representing a wide variety of inducing lesions. For each agent, the frequency of induced SCE was linearly related to the induction of mutation, but the efficiency of SCE formation relative to mutation induction differed for each. Studies in repair deficient cells suggested that unrepaired lesions enhanced the induction of both SCE and mutation but that the degree of enhancement was not necessarily the same for both endpoints.

19213 **Pulmonary toxicity of methylcyclopentadienyl manganese tricarbonyl: nonciliated bronchiolar epithelial (Clara) cell necrosis and alveolar damage in the mouse, rat, and hamster.** Hakkinen, P.J.; Haschek, W.M. (Oak Ridge National Lab., TN). *Toxicology and Applied Pharmacology;* **65**: 11-22(1982). Contract W-7405-ENG-26.

Methylcyclopentadienyl manganese tricarbonyl manganese tricarbonyl (MMT) was administered ip to young female BALB/c mice (120 mg MMT/kg), S/A albino rats (5 mg MMT/kg), or LV_6/LAK Syrian hamsters (180 mg MMT/kg). This administration resulted in lung cell damage followed by cellular proliferation, which was quantified by measuring increases in thymidine incorporation into DNA (mouse, rat, and hamster) and by labeling indices (LI) determined from cell kinetic studies (mouse and rat). Thymidine incorporation into pulmonary DNA was significantly elevated within 1 to 2 days following MMT treatment in all three species, with peak incorporation occurring on Day 2 in the rat and hamster, and Day 4 in the mouse. Both bronchiolar and parenchymal LI were elevated at this time. Alveolar damage and nonciliated bronchiolar epithelial (Clara) cell necrosis were evident within 1 day of injection. This finding was followed by type II epithelial and Clara cell proliferation. Ultrastructurally, in the mouse, mitochondrial swelling and degeneration preceded Clara cell necrosis. Bronchiolar damage was most severe in the mouse, whereas parenchymal damage was most severe in the rat. These results suggest that the mouse, rat, and hamster have different susceptibilities to MMT-induced injury.

19214 **Assessment of the impact on crops of effluent gases from geothermal energy development in the Imperial Valley, California.** Kercher, J.R. (Lawrence Livermore National Lab., CA). *Journal of Environmental Management;* **15**: 213-228(1982). Contract W-7405-ENG-48.

The potential impact of regionally dispersed sources of geothermal gaseous effluents on crops in the Imperial Valley was assessed. A detailed model of the photosynthesis and growth of sugar beets fumigated by H_2S and CO_2 and generalized from the model calculations to other crops was used. Model calculations were made with estimates of time series of expected ground-level concentrations of H_2S and CO_2 calculated by the air quality assessment element of the Imperial Valley Environmental Project (IVEP) at 22 locations around the valley. The model calculations also used time series data of meteorological variables such as air temperature, solar radiation, and relative humidity, which were measured by the air quality baseline element in the field of the Imperial Valley. Results indicate that, in the absence of interactions with other ambient pollutant gases, all location would experience an increase (from slight to significant) in total growth of sugar beets. Seven locations will experience an increase of at least 10%. The emissions rate at which negative effects cancel out the benefits of H_2S fertilization was calculated; in the worst case, emission rates are expected to be no more than 1/13 of this crossover rate. The expected emission rate will be less than that necessary for negative effects on the most sensitive species (such as alfalfa) by a factor of 4. Similar results for other crops are summarized in the report. If CO_2 emissions are increased proportionately, the dominance of deleterious effects is not expected to occur, even under maximum development as set forth in IVEP scenario projections. 8 figures, 6 tables.

19215 **Influence of mercaptoethanol on the isolation of mercury-binding proteins from the gills of Mytilus edulis.** Roesijadi, G.; Drum, A.S. (Marine Research Lab., Sequim, WA). *Comparative Biochemistry and Physiology;* **71B**: No. 3, 455-459(1982). Contract AC06-76RL01830.

Use of the reducing agent 2-mercaptoethanol during extraction and isolation of low molecular weight, mercury-binding proteins of mussel gills resulted in an appearance of significant quantities of mercury associated with substances of <3000 daltons. The source of this mercury was mercury originally bound to the pellet, high molecular weight proteins, and low molecular weight, mercury-binding proteins. This shift in mercury distribution is regarded as a procedural artifact caused by reduction of mercury-binding sites and possible association of released mercury with mercaptoethanol. Use of mercaptoethanol did not release significant amounts of the

metal-binding proteins from the high molecular weight protein pool. 4 figures.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 18154, 18155

19216 **(PB—84-139633) Health hazard evaluation report No. HETA 81-435-1142, NCR Microelectronics-Miamisburg, Miamisburg, Ohio.** Parr, W.H.; Murray, W.E.; Flesch, J.P. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1982. 19p. NTIS, PC A02/MF A01.

The Health Hazard Evaluation request concerned radiofrequency (RF) radiation from barrel plasma etchers and parallel plasma etchers. On September 2, 1981, NIOSH measured the radiation from nine etchers in use by the company. On June 17, 1982, a follow-up survey was made after installation of controls. After the recommended controls were installed, no detectable radiation was found. On the basis of the initial measurements, NIOSH investigators concluded that operators of the systems surveyed would not be exposed to radiofrequency radiation at their normal working distances. However, under some conditions that require a close observance of the etching process, the eyes and hand could possibly be exposed to excessive levels of electric-field radiation. Because of this potential exposure, protective measures for reducing radiation levels were recommended, instituted, and their effectiveness demonstrated.

19217 **(PB—84-139674) Health hazard evaluation report No. HETA 82-048-1132, Taylor Lock Company, Inc., Philadelphia, Pennsylvania.** Lewis, F.; Shoemaker, W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1982. 10p. NTIS, PC A02/MF A01.

On November 30, 1981, NIOSH received a request for technical assistance to evaluate the potential health effects of a new radiofrequency heat sealing machine at the Taylor Lock Company. The heat sealer operators had complained of experiencing dizziness and headaches when working at the machine. On January 7, 1981, electric (E) and magnetic (H) field strength measurements of RF radiation were taken at the eyes, neck, chest, waist, gonads, knees, ankles, and hands of the operators of the RF heat sealer. NIOSH investigators concluded that there was a RF radiation hazard to the operator at the unloading end of the machine. Recommendations are made in the body of the full report to reduce the RF radiation exposure to the worker.

19218 **Electrophoretic mobility of isolated retinal rod outer segment disk by laser doppler spectroscopy.** Gruner, S.M. (Princeton Univ., NJ); Uzgiris, E.E. *Biochemical and Biophysical Research Communications;* **109**: No. 2, 402-407(Nov 1982). Contract AC02-76EV03120.

Laser Doppler Spectroscopy has been used to measure the electrophoretic mobility of isolated bovine retinal rod outer segment disks. The mobility of dark adapted disks is found to be 0.95 μm/sec/v/cm at pH 7.0. The extrapolated isoelectric point is at pH 3.8. To within a two minute time resolution, no change in the mobility is observed upon bleaching of rhodopsin. However, a roughly 12% increase in the mobility occurs upon ultraviolet irradiation.

19219 **Genetic effects of strong magnetic fields in Drosophila melanogaster. III. Combined treatment with homogeneous fields and gaseous DBCP.** Kale, P.G.; Baum, J.W. (Brookhaven National Lab., Upton, NY). *Mutation Research;* **105**: 79-83(1982). Contract AC02-76CH00016.

Exceptionally large magnets of very high field intensity may be used in future thermonuclear reactors. It is estimated that the magnetic field, a few meters from the shields where operating personnel may work, will be 10's to 1000's times the geomagnetic background. With the safety of these personnel in mind, investigations on genetic effects of strong magnetic fields were undertaken. No indication of enhanced mutation induction was observed in males of Drosophila exposed to fields ranging from 13000 to 37000 g. The authors now report a lack of detectable effect from exposure to strong magnetic fields following exposure to a gaseous environmental mutagen.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 18261, 18640

19220 **(GEPP-TIS—786) Human factors: a necessary tool for industry.** Starcher, K.O. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 9 Mar 1984. Contract AC04-76DP00656. 12p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007531.

The need for human factors (ergonomics) input in the layout of a ferroelectric ceramics laboratory is presented as an example of the overall need for human factors professionals in industry. However, even in the absence of one trained in human factors, knowledge of a few principles in ergonomics will provide many possibilities for improving performance in the industrial environment.

19221 **(K/P—6791) Operational safety requirements at the Oak Ridge Gaseous Diffusion Plant.** McRae, N.G. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1984. Contract W-7405-ENG-26. 11p. (CONF-840257—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007473.

From DOE nuclear reactor and facility safety conference; Rockville, MD, USA (27 Feb 1984).

An introduction to UF_6 handling at the Oak Ridge Gaseous Diffusion Plant (ORGDP) is provided. The physical properties and hazards of UF_6 are discussed. A summary of the history of safety analysis work including the UF_6 Cylinder Handling Committee, Engineering Safety Analysis, and the interim Operational Safety Requirements are included. The ORGDP's experience operating under the interim OSR is discussed. The present status of the Final Safety Analysis and Final Operational Safety Requirements documents is also discussed.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 18254, 19231

19222 **(DOE/NV/10058—1) Investigation of the mineral potential of the Clipper Gap, Lone Mountain-Weepah, and Pipe Spring plutons, Nevada.** Tingley, J.V.; Maldonado, F. (Nevada Bureau of Mines and Geology, Reno (USA)). 15 Sep 1983. Contract AC08-79NV10058. 131p. NTIS, PC A07; 3; GPO Dep. Order Number DE84000511.

Paper copy only, copy does not permit microfiche production.

The Clipper Gap pluton, composed mostly of quartz monzonite with minor granite, granodiorite, and crosscutting alaskite dikes, intrudes Paleozoic western facies strata. A narrow zone of contact metamorphism is present at the intrusive-sediment contact. No mineral production has been recorded from Clipper Gap, but quartz veins containing gold-silver-copper mineral occurrences have been prospected there from the late 1800's to the present. Areas of the Lone Mountain-Weepah plutons that were studied are located in Esmeralda County about 14 km west of Tonopah, Nevada. At Lone Mountain, a Cretaceous intrusive cuts folded Precambrian and Cambrian sediments. Lead-zinc ores have been mined from small replacement ore bodies in the Alpine district, west of Lone Mountain. Copper and molybdenum occurrences have been found along the east flank of Lone Mountain, and altered areas were noted in intrusive outcrops around the south end of Lone Mountain. Mineral occurrences are widespread and varied with mining activity dating back to the 1860's. The Pipe Spring pluton study area is flanked by two important mining districts, Manhattan to the north and Belmont to the northeast. Mining activity at Belmont dates from 1865. Activity at Manhattan was mainly between 1907 and 1947, but the district is active at the present time (1979). Four smaller mining areas, Monarch, Spanish Springs, Baxter Spring, and Willow Springs, are within the general boundary of the area. The Pipe Spring pluton study area contains numerous prospects along the northern contact zone of the pluton. Tungsten-bearing veins occur within the pluton near Spanish Springs, with poten-

tial for gold-tungsten placer in the Ralston Valley. Nickel and associated metals occur at Willow Spring and Monarch Ranch, where prospects may be associated with the margin of the Big Ten Peak Caldera.

19223 **(NUREG/CR—3390) Documentation and user's guide: UNSAT2 - variably saturated flow model (including 4 example problems). Final report.** Davis, L.A.; Neuman, S.P. (Water, Waste and Land, Inc., Fort Collins, CO (USA)). Dec 1983. 206p. (WWL/TM—1791-1). NTIS, PC E05/MF $7.75 - GPO. Order Number DE84900892.

Includes 15 sheets of 24x reduction microfiche.

This report presents documentation and a user's guide for program UNSAT2. Mathematical equations and physical principles utilized to develop the code are presented in Section 2. The numerical approach used (Galerkin Finite Elements) is presented in Section 3. Section 4 presents an overview of how problems should be set up to properly use the code while detailed input instructions are presented in Section 5. Output produced by the code is discussed in Section 6. Four example problems, including sample input data sets and output data, are presented in Section 7. Program information and a complete listing of the program is provided in Section 8. This report was prepared as part of a project in which the NRC staff was presented a training course on how to properly use this computer program. Program UNSAT2 can be utilized to analyze flow in unsaturated, partially saturated, or fully saturated flow regions. It is anticipated that the NRC will use the model for checking information provided by a licensee, for evaluating alternative sites and designs for waste disposal, and for comparing their results with results from other methods of solution. 19 references, 37 figures, 25 tables.

19224 **Geotechnology in Massachusetts.** Farquhar, O.C. (ed.). Amherst, MA; Univ. of Massachusetts (1982). 626p. (CONF-8003192—). University of Massachusetts, Amherst 01003.

From Conference on geotechnology in Massachusetts; Boston, MA, USA (20 Mar 1980).

A volume containing papers presented at a conference on geotechnology in Massachusetts is presented. The papers deal with: (1) bedrock geology; (2) surficial geology; (3) hydrogeology; (4) geophysics; (5) soil engineering and rock mechanics; (6) underground space; (7) energy and the geosciences; (8) industrial rocks; (9) mineral resources; (10) environmental and geochemical problems; (11) tectonics; (12) nearshore zones; and (13) the marine boundary. Fourteen of the papers have been abstracted for the US Department of Energy Technical Information Center's Energy Data Base. The majority of these papers deal with undergound energy storage. Other subjects include petroleum storage in salt caverns, geologic aspects of nuclear power plant siting, peat, and coal deposits. (JMT)

5802 Geophysics

REFER ALSO TO CITATION(S) 18931

19225 **(AD-A—134895/2) Body and surface wave modeling of observed seismic events. Semi-annual technical report, 1 October 1977-31 March 1978.** Harkrider, D.G.; Helmberger, D.V.; Minster, J.B. (California Inst. of Tech., Pasadena (USA). Seismological Lab.). 25 Apr 1978. 75p. NTIS, PC A04/MF A01.

Discussion is prsented under the headings: time functions for nuclear explosions; A comparison of generalized ray and normal mode seismograms; Modeling earthquakes with generalized ray theory; and Theoretical fault and block conversion of explosion P waves into SH and SV waves.

19226 **(NUREG/CR—3145-Vol.2) Geophysical investigations of the western Ohio-Indiana region. Annual report, October 1982-September 1983.** Pollack, H.N.; Christensen, D.H. (Michigan Univ., Ann Arbor (USA). Dept. of Geological Sciences). Mar 1984. 93p. NTIS, PC A05/MF A01 - GPO $4.50. Order Number DE84900923.

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Earthquake activity in the western Ohio-Indiana region is monitored with a precision seismograph network which consists of nine stations located in west central Ohio and four stations sited in Indiana. Five local and near regional earthquakes have been recorded during this report period. Three events were located outside the array, near the cities of Kalamazoo, Michigan, Cleveland, Ohio and Cincinnati, Ohio. Two events occurred in the center of the Ohio array. A focal mechanism was calculated for the larger of these two events. This focal mechanism shows mainly strike slip motion on steeply dipping nodal planes, striking at N35°-45°E and N50°-70°W. Both of these planes correspond to local structures. 7 references, 12 figures, 6 tables.

19227 **Measurements of Rayleigh-wave phase velocities in Nevada; implications for explosion sources and the Massachusetts Mountain earthquake.** Patton, H.J. (Lawrence Livermore National Lab., CA). *Bulletin of the Seismological Society of America;* **72**: No. 4, 1329-1349(Aug 1982). Contract W-7405-ENG-48.

Single-station measurements of Rayleigh-wave phase velocity are obtained for paths between the Nevada Test Site and the Livermore broadband regional stations. Nuclear underground explosions detonated in Yucca Valley were the sources of the Rayleigh waves. The source phase phi/sup s/ required by the single-station method is calculated for an explosion source by assuming a spherically symmetric point source with step-function time dependence. The phase velocities are used to analyze the Rayleigh waves of the Massachusetts Mountain earthquake of 5 August 1971. Measured values of source phase for this earthquake are consistent with the focal mechanism determined from P-wave first motion data. A moment-tensor inversion of the Rayleigh wave spectra for a 3-km-deep source gives a horizontal, least-compressive stress axis oriented N63°W and a seismic moment of 5.5 x 10^{22} dyne-cm. The general agreement between this work and the work of others on P-waves supports the measurements of phase velocities and, in turn, the explosion source model used to calculate phi/sup s/. 20 references, 15 figures.

19228 **Interpretation of volcanic gas data from tholeiitic and alkaline mafic lavas.** Gerlach, T.M. (Sandia National Labs., Albuquerque, NM). *Bulletin Volcanologique;* **45**: No. 3, 235-244(1982). Contract AC04-76DP00789.

The analyses of approximately 100 high temperature gas samples from erupting lavas of Surtsey, Erta Ale, Ardcukoba, Kilauea, Mount Etna and Nyiragongo exhibit erratic compositions resulting from analytical errors, condensation effects, reactions with sampling devices, and contamination by atmospheric gases, meteoric water and organic material. Computational techniques have been devised to restore reported analyses to compositions representative of the erupted gases. The restored analyses show little evidence of short-term variations. The principal species are H_2O, CO_2, SO_2, H_2, CO, H_2S, S_2, and HCl. The O_2 fugacities range from nickel-nickel oxide to a half order of magnitude below quartz-magnetite-fayalite. There is no evidence for a unique magmatic gas composition; instead, the erupted gases show regular compositional trends characterized by decreasing CO_2 with progressive outgassing. The gases from more alkaline lavas (Etna, Nyiragongo) are distinctly richer in CO_2, while those from less alkaline (Surtsey) or tholeiitic lavas (Erta Ale, Ardoukoba) tend to be richer in H_2O. Kilauean gases range from CO_2-rich to H_2O-rich. The total sulfur contents of the erupted gases show an excellent positive correlation with lava O_2 fugacity. All restored analyses are significantly lower in H_2O and enriched in sulfur and CO_2 compared to the excess volatiles. 30 references.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 18172, 18187, 18238

19229 **(BMFT-FB-T—83-218) Development of mathematical models from the results of laboratory tests to describe the material behavior of rock salt and its dependence on time and temperature together with calculations based on continuum mechanics using the method of finite elements.** Heusermann, S.; Lux, K.H.; Rokahr, R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1983. 434p. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE84750515.

Determination of the long-term deformation behavior is of great importance for the stability analysis of underground openings in rock salt. However, material laws currently used for forecasting long-term behavior often produce considerably differing results. For this reason, comparison and validification of a few typical formulation of the material laws was carried out to see if they are suitable for an accurate determination of the creep behavior of rock salt. The required material parameters were determined from standardised creep tests on salt samples obtained from various different deposits. The material laws were then verified by comparison with a number of creep curves obtained in tests with both constant and stepwise varying loads. Furthermore, for the purpose of checking, and as an aid to the judgement of the material laws, calculations of cavity convergence were carried out using the method of finite elements. Comparison of the results of the creep tests with the theoretical calculation showed that a modified formulation of the material law according to BERGER, which is based on strain hardening for the primary creep component, is able to realistically describe the complex deformation behaviour of rock salt under a wide range of different load situations. The new formulation thus enables a realistic prediction of cavity convergence in rock salt to be made, even in the presence of changing external loads.

19230 **(PB—84-129741) Permafrost research: an assessment of future needs.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). 1983. 121p. NTIS, PC A06/MF A01.

Permafrost--ground that remains continuously at temperatures below 0 C for two years or longer--covers nearly one fourth of the land surface of the earth and poses special engineering problems. The report examines the status of permafrost research, identifies the most urgent research and engineering needs, and recommends priorities to guide future effort in this field. Recommendations deal with detection and mapping, heat and mass transport processes, performanace monitoring, ground ice, active layer and ground temperature, material properties, development and application of technology, information management and transfer, and international cooperation.

5804 Geochemistry

REFER ALSO TO CITATION(S) 18151, 18186, 18248, 18384, 19228

19231 **(DOE/ER/13112—1) Geochemistry and origin of regional dolomites.** Hanson, G.N. (State Univ. of New York, Stony Brook (USA). Research Foundation). 1984. Contract AC02-83ER13112. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008257.

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The objective is to develop quantitative, geochemical models for the source, flow-paths and chemistry of the diagenetic fluids responsible for the widespread dolomitization of the Mississippi Burlington-Keokuk Fms. In Iowa, Illinois and Missouri by integrating geochemistry, fluid inclusion studies, conventional and luminescent petrography, stratigraphy, facies analysis and burial history. The original area of study has been significantly expanded and now includes western Illinois and eastern Missouri as well as southeastern Iowa. This includes most of the area where good sections of the Burlington-Keokuk Formations are exposed and almost the complete range of facies from near shore to the platform edge. Stratigraphic sections and depositional facies maps are being prepared for Illinois, Missouri and Iowa for Osagean time. The geochemical studies include: correlation of the major and trace element variations within the various Burlington dolomites developed in southeastern Iowa and adjacent areas of Illinois and Missouri; rare earth element, Nd and Sr isotope analysis of the dolomites and coexisting phases; major and trace element analysis, petrography and x-ray mineralogy of selected shaly members in the Burlington-Keokuk formations; and fluid inclusion studies of the calcites and dolomite cements of southeastern Iowa. 8 figures.

64 PHYSICS. I.

19232 **(FERMILAB-Conf—84/27) Future of computing technology in physics - the potentials and pitfalls.** Brenner, A.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1984. Contract AC02-76CH03000. 21p. (CONF-840260—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007249.

From Annual joint APS/AAPT meeting; San Antonio, TX, USA (2 Feb 1984).

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The impact of the developments of modern digital computers is discussed, especially with respect to physics research in the future. The effects of large data processing capability and increasing rates at which data can be acquired and processed are considered. (GHT)

6401 Astrophysics And Cosmology

19233 **(AD-A—135085/9) Study of the magnetic evolution of active regions and its relation to solar flares. Final report 21 Apr 81-20 Jul 82.** Chapman, G. (California State Univ., Northridge (USA)). 30 Jan 1983. 21p. NTIS, PC A02/MF A01.

Observations of solar magnetic fields and associated activity, obtained with a Magnesium b-line (5172 A) Etalon Filter, are described. Particular emphasis is placed on flares visible in the wings of the Magnesium line; such flare structures are of small size (4-6 arcsec) and their intensities are strongly correlated with soft x-ray fluxes.

19234 **(CBPF-CS—001/82) New cosmology.** Novello, M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 19p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700673.

The mainly characteristics of White Hole and also the bifurcation process in cosmos begining are described.

19235 **(CBPF-NF—015/82) Bifurcation in the cosmos.** Novello, M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700674.

It is argued on the final configuration of the cosmos and the possibility of the Universe to be running possibly into an unpredictable era is showed.

19236 **(CBPF-NF—019/82) Perturbations of the Friedmann Universe.** Novello, M.; Salim, J.M.; Heintzmann, H. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1982. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700675.

Correcting and extending previous work by Hawking (1966) and Olson (1976) the complete set of perturbation equations of a Friedmann Universe in the quasi-Maxwellian form is derived and analized. The formalism is then applied to scalar, vector and tensor perturbations of a phenomenological fluid, which is modelled such as to comprise shear and heat flux. Depending on the equation of state of the background it is found that there exist unstable (growing) modes of purely rotational character. It is further found that (to linear order at least) any vortex perturbation is equivalent to a certain heat flux vector. The equation for the gravitational waves are derived in a completely equivalent method as in case of the propagation, in a curved space-time, of electromagnetic waves in a plasma endowed with some definite constitutive relations.

19237 (CERN—83-05, pp 281-300) **Astrophysics, cosmology and high energy physics.** Rees, M.J. (Cambridge Univ. (UK). Inst. of Astronomy). 22 Jun 1983. NTIS (US Sales Only), PC A14/MF A01. (CONF-8209205—).

From CERN school of physics '82 meeting; Cambridge, UK (1 Sep 1982).

A brief survey is given of some topics in astrophysics and cosmology, with special emphasis on the inter-relation between the properties of the early Universe and recent ideas in high energy physics, and on simple order-of-magnitude arguments showing how the scales and dimensions of cosmic phenomena are related to basic physical constants.

19238 (INIS-mf—8696, pp 45-48) **Angular momentum coupling in differentially rotating galactic systems.** Evangelidis, E. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Physics Div.). 1982. NTIS (US Sales Only), PC A08/MF A01. (CONF-8107124—; CONF-8007147—).

From 16. annual seminar on theoretical physics; Port Elizabeth, South Africa (14 Jul 1981).

The equations of motion are derived and the existence of a force term is demonstrated due to the coupling of the angular momentum with the gradient of the angular frequency. Furthermore, the possibility is shown that this coupling could well provide the mechanism for the expansion of galactic systems.

19239 (INS-J—164, pp 87-117) **Amphysics and pregeometry - from the origin of the matter to that of our universe.** Terazawa, Hidezumi (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

The recent progress in "amphysics" and pregeometry in which not only leptons and quarks but gauge bosons, Higgs scalars, and gravitons are all composites of more fundamental particles (called "ams") is reviewed. The subjects discussed include 1) origin of flavors and colors, 2) lepton and quark mass spectra, 3) quark (and lepton) mixings, 4) lepton and quark magnetic moments, 5) leptons and quarks of spin 3/2 or higher, 6) exotic states of ams, 7) generation (or family) problem, 8) techniquarks vs. ams, 9) grand unification vs. ams, and 10) am supergravity vs. am pregeometry. The pregeometric origin of the big bang of our universe is also discussed.

19240 **(LBL—17279) Measurement of the intensity of the cosmic background radiation at 3.0 cm.** Friedman, S.D. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84008246.

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The intensity of the cosmic background radiation (CBR) has been measured at a wavelength of 3.0 cm as part of a program to measure th Rayleigh-Jeans spectrum of the CBR at five wavelengths between 0.33 cm and 12 cm. The instrument used is a dual-antenna Dicke-switched radiometer with a double-sideband noise temperature of 490 K and a sensitivity of 46 mK/Hz/sup 1/2/. The entire radiometer is mounted on bearings. The atmospheric emission was measured by rotating the radiometer, and thus directing one antenna to zenith angles of +- 30° and +- 40°. 61 references, 24 figures, 18 tables.

19241 **(PB—84-128818) Deuterated water in Orion-KL and W51M.** Olofsson, H. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Raaoe Rymndobservatorium). 12 Sep 1983. 18p. (R—83/31). NTIS, PC E03/MF E01.

The author has mapped the HDO (1 sub 10 - 1 sub 11) line emission in the Orion-KL region. Features with hot core, plateau, and 8 km/s ridge cloud characteristics are found. The HDO hot core and CH3CH2CN emissions are located between the infrared sources IRc2 and IRc4. In the Orion plateau source the abundance of H2O approaches that of CO. The possibility of an H2O enhancement in warm and dense regions is discussed. Reliable estimates of the (HDO)/(H2O)-ratio are not possible to give with the currently available observational data, since both species appear to be anomalously excited.

19242 **(RRK—82-9) Large-scale anisotropy of the cosmic background radiation due to primordial density and gravitational-wave perturbations.** Tomita, Kenji; Tanabe, Kenji. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Sep 1982. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700677.

The possibility that part of the recently discovered large-scale anisotropy of the cosmic background radiation is aroused from primordial density and gravitational-wave perturbations through the Sachs-Wolfe effect, is investigated in both closed and open models in connection with the severe constraint for the small-scale anisotropy. It is concluded that, in order to explain the dipole anisotropy of the order of 10^{-3} by density perturbations, closed models and density fluctuation spectrums not steeper than "white noise" one are required, and that gravitational-wave perturbations cannot contribute to the possible quadrupole anisotropy of the order of 10^{-4}.

19243 **(RRK—82-10) Creation of scalar particles in an early stage of the Friedmann closed-universe II. The method in terms of the Feynman propagator.** Ishihara, Hideki; Nariai, Hidekazu. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Sep 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700676.

As a sequel to the previous work, the creation of scalar particles in an expanding closed-universe is studied in terms of our Feynman propagator and of fixing a pair of particle states. It is shown that the obtained spectral law for the creation of particles is identical with the previous one derived in terms of the vacuum expectation value at an initial time eta = eta sub(i) of the number operator at late time eta = eta sub(f).

19244 **(TRITA-EPP—83-04) Solar system history as recorded in the Saturnian ring structure.** Alfven, H. (Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics). Apr 1983. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700678.

The paper is based on Holbergs analysis of the Voyager photographs in both reflected and transparent light, combined with occulation data of stars seen through the rings. Besides rapidly varying phenomena (spokes, braided ring, etc.), which according to Mendis are due to gravito-electromagnetic effects, the ring consists of a bulk structure, a fine structure, and also a hyperfine structure, showing more than 10000 ringlets. The large number of ringlets can be explained by the Baxter-Thompson negative diffusion. This gives the ringlets a stability which makes it possible to interprete them as fossils, which originated at cosmogonic times. It is shown that the bulk structure can be explained by the combined cosmogonic shadows of the satellites Mimas, Janus (co-orbiting satellites) and the Shepherd satellites. This structure originated at the transition from the plasma phase to the planetesimal phase (which probably took place 4-5 times 10^9 years ago). Further, Holberg has discovered that the shadows are not simple void regions but exhibit a certain characteristic signature. This is not yet understood theoretically. Parts of the fine structure are explained by Holberg as resonances with the satellites. Parts are here interpreted as cosmogonic shadow effects. However, there are a number of ringlets which can neither be explained by cosmogonic nor by resonance effects. The most important conclusion is that an analysis of the ring data is likely to lead to a reconstruction of the plasma-planetesimal transition with an accuracy of a few percent.

19245 **Giant radiogalaxies.** Saunders, R.D.E. Cambridge, England; Cambridge University (1983). 180p. British Library, Boston Spa, Wetherby, West Yorks. No. D43291/82.

The large angular sizes of nearby giant radiogalaxies are exploited to study source physics. High resolution observations of the jet in NGC 6251 indicate the presence of ionised matter, and the argument that the jet must create the lobe in the lobe lifetime implies a jet speed of c/20; the form of the observed jet wiggles suggest they are caused by collimator precession. Multifrequency observations of 3C236 show a gradual aging of tail material from heac to nucleus and a constant head advance speed of c/11 is inferred The polarisation structure of a hotspot is revealed by observation

of DA240. Two studies are presented of extended sources selected from the confusion-limited 6C survey. The first is of a variety of 6C source morphologies mapped at higher resolution to reveal new giants, steep-spectrum sources and clusters but no nearby sources masquerading as giants. The second is a flux-density-limited 6C sample mapped with the 5-km telescope. Optical spectroscopic observations of the nuclei of new giants are described and support the use of the standard candle assumption.

19246 **Clusters of galaxies in the Centaurus and Horologium-Reticulum regions.** Lucey, J.R. Brighton, England; Sussex University (1981). 220p. British Library, Boston Spa, Wetherby, West Yorks. No. D44949/83.

A brief review of galaxy clusters is presented. Spectral scans of galaxies in the Centaurus 1 and Horologium-Reticulum regions were made with the Anglio-Australian Telescope.

6402 Atmospheric Physics

19247 **(AD-A—136030/4) Anomalous transport in current sheets. Memorandum report.** Huba, J.D. (Naval Research Lab., Washington, DC (USA)). 25 Nov 1983. 27p. (NRL-MR—5220). NTIS, PC A03/MF A01.

A review of several microinstabilities have been suggested as possible anomalous transport mechanisms in current sheets is presented. The specific application is to a field reversed plasma which is relevant to the so-called diffusion region of a reconnection process. The linear and nonlinear properties of the modes are discussed, and each mode is assessed as to its importance in reconnection processes based upon these properties. It is concluded that the two most relevant instabilities are the ion acoustic instability and the lower-hybrid-drift instability. However, each instability has limitations as far as reconnection is concerned, and more research is needed in this area.

19248 **(AD-A—136396/9) Phenomenology of structured plasma in the ionosphere. Technical report.** Vickrey, J.F.; Cousins, M.D.; Tsunoda, R.T.; Walker, N.B.; Livingston, R.C. (SRI International, Menlo Park, CA (USA)). 1 Mar 1983. 100p. NTIS, PC A05/MF A01.

This report summarizes the results of the past year's efforts at SRI International to investigate experimentally and theoretically the processes that control the evolution of plasma structure in the natural and the nuclear environments. Important new results include a description of the anisotropy of large-scale and scintillation-producing plasma density irregularities at high latitudes and its convection domination, the refinement of a method to extract true irregularity drifts from spaced-receiver measurements, the first experimental observations of the formation of image striations, a model of image formation that shows the process (in agreement with observations) to be highly scale-size selective, and evidence that the previously puzzling seasonal patterns of equatorial spread-F occurrence are a result of the seasonal changes in the time of sunset in the conjugate E layers.

19249 **(LA-UR—84-512) Microtheory of collisionless shock current layers.** Winske, D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 43p. (CONF-840256—1). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007500.

From Chapman conference on collisionless shock waves in the heliosphere; Napa Valley, CA, USA (20 Feb 1984).

The present status of understanding of microscopic dissipation processes in the current layer of collisionless shocks is reviewed. The emphasis is on cross-field current-driven instabilities and their importance in quasiperpendicular shocks, although other processes which arise in quasiparallel shocks are also discussed. A general prescription is given for calculating turbulent heating and resistivity in shocks. 112 references.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 18799, 19002, 19312, 19312, 19398, 19434

19250 **(AD-A—135801/9) Inelastic x-ray scattering cross sections of Ne.** Parente, F. (Oregon Univ., Eugene (USA). Dept. of Physics). 1983. 16p. NTIS, PC A02/MF A01.

19251 **(BNL—34242) Report on the BNL H^- ion source development.** Prelec, K. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 11p. (CONF-831180—27). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007392.

From 3. international symposium on the production and neutralization of negative ions and beams; Upton, NY, USA (14 Nov 1983).

This paper is a report on H^- ion source development at BNL over the past ten years, with most emphasis on the selected approach for the design of a steady state operating source. Sources of this kind will be used in neutral beam lines of future fusion devices, for plasma heating and toroidal current drive. In addition to the steady state operation, H^- ion sources for this application have to show very high gas and power efficiencies. 16 references, 8 figures.

19252 **(BONN-HE—83-19) Non-perturbative treatment of relativistic quantum corrections in large Z atoms.** Dietz, K.; Weymans, G. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Sep 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750906.

Renormalised g-Hartree-Dirac equations incorporating Dirac sea contributions are derived. Their implications for the non-perturbative, selfconsistent calculation of quantum corrections in large Z atoms are discussed.

19253 **(DOE/ER/40071—1) Theoretical research on selected topics of mesonic atoms.** Seki, R. (California State Univ., Northridge (USA)). 1984. Contract AM03-82ER40071. 9p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009089.

Progress is briefly reported on three topics: (1) the anomalous 3d shifts and widths in heavy pionic atoms; (2) mesonic atom experiments; and (3) effect of intermediate-state Coulomb interaction in pion-nucleus scattering. (WHK)

19254 **(DOE/EV/04703—44) Interaction of slow electrons with high-pressure gases (Quasi-liquids). Synthesis of our knowledge on slow electron-molecule interactions. Progress report for year ending June 15, 1984.** McCorkle, D.L.; Christophorou, L.G. (Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy). 1984. Contract AS05-76EV04703. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008354.

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A crucial step in efforts to develop not only a coherent picture of radiation interaction with matter, but also to understand radiation effects and mechanisms, as well as the effects of chemical pollutants and toxic compounds, is to relate the often abundant knowledge on isolated molecules (low pressure gases) to that on liquids or solids. To understand the roles of the physical and chemical properties of molecules in biological reactions, the way these isolated-molecule properties change as molecules are embedded in gradually thicker and thicker (denser and denser) gaseous and, finally, liquid environments must be known. The work reported here, carried out both at the Physics Department of the University of Tennessee and at the Oak Ridge National Laboratory addresses itself to this question. At both places, high pressure (40 to $\sim$ 8000 kPa) electron swarm experiments are currently in operation yielding the first information as to the effects of the density and nature of the environment on fundamental electron-molecule interaction processes at densities intermediate to those corresponding to low pressure gases and liquids, and the gradual transition from isolated molecule to condensed phase behavior. Basic physical data on the electronic states of atmospheric halocarbons in general, and of polycyclic aromatic hydrocarbons in particular were also studied.

Such data are of special significance because of the occurrence of these molecules in the atmosphere, and are presently lacking.

19255 **(DOE/OR/05784—6) Selective excitation, relaxation, and energy channeling in molecular systems. Progress report, December 1, 1982-February 29, 1984.** Rhodes, W.C. (Florida State Univ., Tallahassee (USA)). 1984. Contract AS05-78EV05784. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008270.

Progress is reported briefly under: role of memory relaxation in molecular phenomena, nonradiative relaxation and quantum beats in the radiative decay of large molecules, refractive index of molecular fluids, and birefringence of molecular fluids. (DLC)

19256 **(GEPP-TIS—366c) Bibliography and author index for electrical discharges in vacuum (1897-1982).** Miller, H.C. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 15 Mar 1984. Contract AC04-76DP00656. 315p. NTIS, PC A14/MF A01; GPO Dep. Order Number DE84008362.

This bibliography covers the field of electrical discharges in vacuum, comprising both electrical breakdown in vacuum and vacuum arcs. A brief review section lists some review papers which would be helpful to the novice in this field. The bulk of the paper consists of bibliographic listings, arranged by year of publication and within each year, alphabetically by first author. An author index refers one to all papers authored or coauthored by a particular person. There are 2752 papers listed through December 1982.

19257 (INIS-mf—8703, pp vp) **Electron impact ionization cross sections for Mo atoms.** Strzondala, V. (Vysoka Skola Banska, Ostrava (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19258 (INIS-mf—8703, pp vp) **Collision-radiative model of helium.** Slavik, J.; Vostracka, M. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19259 (INIS-SU—198, pp vp) **Coherent ensemble of atomic nuclei. On possibility of coherent ion beam production.** Izosimov, I.N.; Naumov, Yu.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19260 (INIS-SU—198, pp vp) **Energy dependence of fine-grain metal target sputtering by heavy multicharged ions.** Baranov, I.A.; Obnorskij, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19261 (INIS-SU—198, pp vp) **Detection of positronium states in zeolites with dispersed nonmetals.** Aref'ev, K.P.; Kuznetsov, P.V.; Kholodkevich, S.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19262 (INIS-SU—198, pp vp) **Shadow effect in the interaction between heavy ions and GaP monocrystal.** Bugrov, V.N.; Karamyan, S.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19263 **(LA-UR—84-431) Patterns of energy levels and spectra for polyatomic molecules.** Harter, W.G. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 28p. (CONF-8311140—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007501.

From Fractal structure in physics conference; Washington, DC, USA (23 Nov 1983).

Portions are illegible in microfiche products.

Laser spectroscopy has revealed a remarkable intricacy in the rotational, vibrational, and electronic energy levels for polyatomic molecules. The infrared spectra of SF_6, CF_4, and related molecules contain several levels of structure on top of structure which resembles a fractal in some ways. The purpose of this article will be to exhibit some of this structure and introduce the simplest theoretical interpretations of it which are presently available.

19264 **(LBL—16968) High resolution reactive scattering.** Neumark, D.M. (Lawrence Berkeley Lab., CA (USA)). Jan 1984. Contract AC03-76SF00098. 178p. NTIS, PC A09/MF A01; GPO Dep. Order Number DE84007962.

Thesis.

A high resolution reactive scattering study has been performed on the reactions $F + H_2 \rightarrow HF + H$, $F + D_2 \rightarrow DF + D$, $F + HD \rightarrow HF + D$, and $F + HD \rightarrow DF + H$, using the crossed molecular beams technique. The resolution of the apparatus was sufficient to allow the determination of differential cross sections and kinetic energy distributions for each HF (DF) vibrational state. This level of detail was necessary to ascertain the role of dynamical resonances in these reactions.

19265 **(LBL—17282) Determination of specific site occupations in single crystals by channelling enhanced microanalysis: principles and applications.** Krishnan, K.M. (Lawrence Berkeley Lab., CA (USA)). Feb 1984. Contract AC03-76SF00098. 170p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84007975.

Portions are illegible in microfiche products; Thesis.

A technique that enhances the potential of energy dispersive x-ray microanalysis is materials characterization called "Channelling Enhanced Microanalysis" has been developed. This technique, based on the orientation dependence of electron-induced characteristic x-ray emissions was then used to determine preferential site occupations of elemental additions in magnetic materials. 111 references.

19266 **Electron capture processes in terms of the theory of radiationless transitions.** Bartczak, W.M.; Swiatla, D.; Kroh, J. (Politechnika Lodzka (Poland)). pp vp of Proceedings of the 5th 'Tihany' symposium on radiation chemistry held at Siofok, 19 - 24 Sep 1982. Budapest, Hungary; Mueszaki es Termeszettudomanyi Egyesueletek Szoevetsege (1982). (CONF-8209164—Summ.).

From 5. Tihany symposium on radiation chemistry; Siofok, Hungary (19 Sep 1982).

19267 **Positronium formation fractions in two Cg hydrocarbons.** Diana, L.M.; Tuttle, S.R.; Sharma, S.C.; Coleman, P.G.; Chuang, S-y. (Texas Univ., Arlington, TX (USA)). pp vp of Proceedings of the 5th 'Tihany' symposium on radiation chemistry held at Siofok, 19 - 24 Sep 1982. Budapest, Hungary; Mueszaki es Termeszettudomanyi Egyesueletek Szoevetsege (1982). (CONF-8209164—Summ.).

From 5. Tihany symposium on radiation chemistry; Siofok, Hungary (19 Sep 1982).

19268 **Solvated electron in ionic solutions. A theoretical model.** Hilczer, M.; Bartczak, W.M.; Feret, B. (Politechnika Lodzka (Poland)). pp vp of Proceedings of the 5th 'Tihany' symposium on radiation chemistry held at Siofok, 19 - 24 Sep 1982. Budapest, Hungary; Mueszaki es Termeszettudomanyi Egyesueletek Szoevetsege (1982). (CONF-8209164—Summ.).

From 5. Tihany symposium on radiation chemistry; Siofok, Hungary (19 Sep 1982).

6404 Fluid Physics

19269 (LA—9969-MS) LINER package: an incipient MHD capability for CCUBE. Gisler, G.R.; Faehl, R.J. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008364.

We describe a code package for moving deformable conductors which has been developed for use with the PIC simulation code CCUBE. In the code package, called LINER, moving conductor elements are each characterized by finite conductivity, mass, and volume. Ohmic currents can arise in the elements, and they can be accelerated by forces exerted by the electromagnetic field. The elements can also change shape and volume.

19270 (NUREG/CR—2896-Vol.1) COMMIX-1A: a three-dimensional transient single-phase computer program for thermal hydraulic analysis of single and multicomponent systems. Volume I: users manual. Domanus, H.M.; Schmitt, R.C.; Sha, W.T.; Shah, V.L. (Argonne National Lab., IL (USA)). Dec 1983. Contract W-31-109-ENG-38. 325p. (ANL—82-25-Vol.1). NTIS, PC A14/MF A01 - GPO; GPO Dep. Order Number DE84007256.

The COMMIX-1A computer program is an updated and improved version of COMMIX-1 designed to analyze steady-state/transient, single-phase, three-dimensional fluid flow with heat transfer in reactor components and multicomponent systems. A new porous-media formulation via local volume averaging has been derived and employed in the COMMIX code. The concepts of volume porosity, directional surface permeability, distributed resistance, and distributed heat source or sink is used in the new porous-media formulation to model a flow domain with stationary structures. The concept of directional surface permeability is new and greatly facilitates modeling of velocity and temperature fields in anisotropic media. The new porous-media formulation represents the first unified approach to thermal-hydraulic analysis. It is now possible to perform a multidimensional thermal-hydraulic simulation of either a single component, such as a rod bundle, reactor plenum, piping system, heat exchanger, etc., or a multicomponent system that is a combination of these components. The conservation equations of mass, momentum, and energy based on the new porous-media formulation are solved as a boundary-value problem in space and an initial-value problem in time. Two other unique features provided in the COMMIX-1A code are (1) two solution procedures - a semi-implicit procedure modified from ICE and a fully-implicit procedure, named SIMPLEST-ANL, similar to the SIMPLE/SIMPLER algorithms - available a user's option and (2) a geometrical package capable of approximating many geometries. This report (Volume I) describes in detail the basic equations, formulations, solution procedures, flow charts, rebalancing scheme for faster convergence, options available to users, models to describe the auxiliary phenomena, input instructions, and two sample problems. The Volume II assembles and summarizes the results of many simulations that have been performed with COMMIX-1A computer program.

19271 Waves on fluid interfaces. Meyer, R.E. (ed.). New York; Academic Press, Inc. (1983). 365p. (DOE/ER/13020—1; CONF-8210143—). Academic Press, Inc., 111 Fifth Ave., New York, NY 10003. Contract FG02-82ER13020.

From Symposium on waves on fluid interfaces; Madison, WI, USA (18 Oct 1982).

This volume collects the invited addresses given at a symposium on fluid interfaces of the Mathematics Research Center of the University of Wisconsin in Madison in October 1982. The articles survey many different aspects of recent research developments, from nonlinear instabilities of classical interfaces to the physical structure of real interfaces and the new challenges they pose to our intuition about fluids. They concern theory and experiment, and touch on many applications of acute interest in technology and medicine. Collectively, they illuminate a multifaceted subject in rapid progress.

19272 Some theoretical considerations concerning superfluidity in spin polarized deuterium. Galil, A.; Modawi, K. Brighton, England; Sussex University (1981). 229p. British Library, Boston Spa, Wetherby, West Yorks. No. D43628/82.

Assuming that a system of spin polarized deuterium atoms can be stabilized at sufficiently low temperatures its transition to a pair correlated state in which the pairs are assumed to be in a zero angular momentum state is considered using the Green's function formulation. The order parameter is a vector in an abstract vector space called here the pseudo spin space. Its structure is considered in detail. An example of the correlation properties of the system is also given. The magnitude of the transition temperature is considered with the density at which the system can be stabilized. There are two difficulties concerning the possibility of an observable transition. First, there is the splitting of the three Fermi surfaces, relevant to spin polarized deuterium, which tends to quench the transition. Secondly, it is recognized that there is a maximum density at which the system can be stabilized even at zero temperature. This presents a difficulty in view of the sensitivity of the value of the transition temperature to the density. These difficulties are discussed. It was found that superfluid spin polarized deuterium, if prepared, will show different features from those observed in other known Fermi superfluids. Its excitation spectrum exhibits a gapless branch at all temperatures below the transition temperature. The correlation properties of this system can be described by a new function of temperature in addition to the usual Yosida function. Near the transition temperature two strong coupling constants are needed for the Ginzburg-Landau free energy. The effect in spin 1/2 Fermi superfluids, which modifies the expression for the transition temperature is absent in the case of spin polarized deuterium.

19273 Some magnetic resonance and quasiparticle ballistic effects in superfluid ^{3}He. Greaves, N.A. Brighton, England; Sussex University (1981). 250p. British Library, Boston Spa, Wetherby, West Yorks. No. D44946/83.

Following a theoretical description of a p-wave paired Fermi superfluid, the situation where the superfluid may be assumed uniform is considered. Precise forms for the gap vector in the A and B phases near Tsub(C) are calculated. Leggett's theory is applied to calculate precise values of the N.M.R. frequencies in the two phases - in particular to obtain an expression for the small transverse shift observed in the B phase by Osheroff. Measurements of this and other N.M.R. frequencies may provide useful information about the parameters occurring in the generalized Ginzburg-Landau expression for the free energy near Tsub(C). Textures in the A phase are then considered. It is shown how certain known textures correspond to stationary values of the generalized expression for the gradient energy in the A phase. The behaviour of the excited quasiparticles in such textures is considered. It is predicted that those quasiparticles with energies less than the gap maximum are, in certain configurations, reflected by the superfluid; a conclusion which is supported by an exact calculation for the de Gennes Configuration in a cylindrical container. This reflection phenomenon significantly inhibits the normal transport properties of the superfluid; this is demonstrated by calculations of the transfer of heat and momentum between two large flat plates under the influence of a perpendicular magnetic field.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 18940, 19300

19274 (BNL—34208) Glueballs in the reaction $\pi p p \rightarrow$ phi phi n at 22 GeV/C. Longacre, R.S. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 26p. (CONF-8304142—2). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008170.

From 7. international conference on meson spectroscopy Upton, NY, USA (14 Apr 1983).

The BNL/CCNY group has observed and performed a partial wave analysis on $\sim$ 4000 (22 GeV) $\pi^- p \rightarrow$ phi phi n events. The OZI suppression has been found to be almost completely broken down. The phi phi spectrum is found to be compose

almost entirely of I/sup G/J/sup PC/ = 0^+2^{++} partially waves which occur in S and D-waves with spin zero and spin two. Assuming (1) QCD is correct, and (2) the OZI rule is universal for weakly coupled glue in disconnected Zweig diagrams due to the creation or annihilation of new types of quarks; it is concluded that one to three primary glueballs with the above quantum numbers are responsible for the observed data. 23 references.

19275 **(BNL—34308) Production of antihyperons in the central region at the ISR. The axial field spectrometer collaboration.** Akesson, T.; Albrow, M.C.; Almehed, S.; Batley, R.; Benary, O.; Boggild, H.; Botner, O.; Breuker, H.; Brody, H.; Burkert, V. (Brookhaven National Lab., Upton, NY (USA); Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Cambridge Univ. (UK); European Organization for Nuclear Research, Geneva (Switzerland); Niels Bohr Inst., Copenhagen (Denmark); Lund Univ. (Sweden)). Jul 1983. Contract AC02-76CH00016. 13p. (CONF-830718—17). NTIS, PC A02; 3; GPO Dep. Order Number DE84008179.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

Paper copy only, copy does not permit microfiche production.

We present measurements of the relative production cross-sections of anti p, anti Λ, anti Ξ, and anti Ω at y ~ 0 for 1 ≦ p/sub T/ ≦ 2 GeV/c in pp collisions at √s = 63 GeV. The results are compared with previous measurements of antibaryon production in hadronic and e^+e^- collisions.

19276 **(BNL—34317) Properties of jets in high-E/sub T/ events produced in pp collisions at √s = 63 GeV.** Akesson, T.; Albrow, M.G.; Almehed, S.; Batley, R.; Benary, O.; Boggild, H.; Botner, O.; Breuker, H.; Brody, H.; Burkert, V. (Brookhaven National Lab., Upton, NY (USA); Cambridge Univ. (UK); European Organization for Nuclear Research, Geneva (Switzerland); Niels Bohr Inst., Copenhagen (Denmark); Lund Univ. (Sweden); Pennsylvania Univ., Philadelphia (USA)). Jul 1983. Contract AC02-76CH00016. 16p. (CONF-830718—18). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008183.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

The properties of jets in high-E/sub tau/ events produced in pp collisions at √s = 63 GeV have been studied at the CERN Intersecting Storage Rings. The fragmentation of the jets is found to be similar to that of jets produced in e^+e^- annihilation. The jets are wider than calculated from a constituent scattering model with no hard bremsstrahlung component. The charge correlations of positive and negative particles show differences consistent with expectation from valence-quark scattering. 11 references.

19277 (CERN—83-05, pp 247-264) **Physics results from the CERN proton-antiproton collider.** Dowell, J.D. (Birmingham Univ. (UK). Dept. of Physics). 22 Jun 1983. NTIS (US Sales Only), PC A14/MF A01. (CONF-8209205—).

From CERN school of physics '82 meeting; Cambridge, UK (1 Sep 1982).

Results from the 1981 operation of the CERN panti p collider at 540 GeV obtained in experiments UA1, UA2, UA4 and UA5 are presented. The total cross section of 66+-7 mb shows the expected rise from lower energies. Elastic scattering measurements are consistent with a lns shrinkage of the forward peak. The central pseudo-rapidity density for inclusive charged particle production rises as lns reaching a value of 3.3 particles per unit of rapidity and the multiplicity distribution exhibits KNO scaling when compared to ISR results below 63 GeV. Results for inclusive photon, strange particle and proton production are also given. The single particle psub(t)-spectrum for psub(t) up to 10 GeV/c is considerably flatter than at the ISR and shows a dependence on multiplicity. Evidence for jets is given. Both jet and single particle cross sections at high psub(t) agree with QCD predictions. Negative searches for Centauro events and free quarks are reported. Finally, future prospects are outlined.

19278 **(DESY—83-042) Charged particle and neutral kaon production in e^+e^- annihilation at PETRA.** Dietrich, G.; Elsen, E.; Heinyelmann, G.; Kado, H.; Meier, K.; Petersen, A.; Weber, G.; Bethke, S.; Dieckmann, A.; Heintze, J. (Muenchen Univ. (Germany, F.R.). Sektion Physik). Jun 1983. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750247.

The mean charged multiplicity as well as its distribution has been measured as a function of c.m. energy in the reaction e^+e^- ->hadrons. Fragmentation models are compared with the data. After applying radiative corrections the mean charged multiplicity is measured to be 8,4 +- 0.3 +- 0.6 at 12 GeV, 13.1 +- 0.3 +- 0,6 at 30 GeV and 13.6 +- 0.3 +- 0.6 at 35 GeV. The ratio of mean charged multiplicity to the dispersion (<Nsub(ch)>/ Dsub(ch)) is almost constant in the energy range studied, indicating KNO scaling of the charged multiplicity. The inclusive differential cross section s(dsigma/dxsub(p)) shows scaling violation in the high kappasub(p) region kappasub(p)>0.15). The absolute value of the scaling violation is consistent with the result of 2nd order QCD caluculations. The production of neutral kaons has been investigated by identifying the decay Ksub(s)^0->$\pi^+\pi^-$. The production probability for a strange quark relative to that of a u or d quark in the fragmentation, γsub(s), has been determined to be 0.27 +- 0.03 +- 0,05 averaged over c.m. energies from 12 to 35 GeV. Momentum spectra for neutral kaons are presented and are compared with model predictions.

19279 **(DESY—83-049) Search for flavour-changing neutral currents in b decay at PETRA.** Dietrich, G.; Elsen, E.; Heinzelmann, G.; Kado, H.; Meier, K.; Petersen, A.; Schneekloth, U.; Weber, G.; Bethke, S.; Dieckmann, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750248.

A study of the reaction e^+e^- -> $\mu^+\mu^-$ + anything at a mean centre of mass energy of approx.= 35 GeV has been carried out to investigate the possible flavour-changing neutral current decay of the b quark. An upper limit of 0.7% at 95% C.L. has been placed on the branching ratio for this process. This limit conflicts with the predictions of a 5-quark model (without top) which assigns the b quark to left- and right-handed singlets.

19280 **(DESY—83-059) Summary of the experimental discussion session.** Spitzer, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 46p. (CONF-8304110—5). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750250.

From 5. international workshop on photon-photon collisions; Aachen, F.R. Germany (13 Apr 1983).

A total of 26 papers have been contributed to the experimental discussion session. I will discuss some of the tools needed for 2γ experimentation and then point to highlights and regions of particular progress in the last two years. The process γγ -> eta -> γγ has been measured for the first time as well as the cross section for γγ -> rho$^+$ rho$^-$. The latter rules out a resonance interpretation for sigma (γγ->rho^{0}rho^0). Progress has been made in understanding the f^0 shape by an interference mechanism. Previous determinations of sigmasub(tot) (γγ -> hadrons) have suffered from limited detector acceptance. The ongoing analyses of PLUTO, JADE and PEP4 + PEP9 data look promising. A separation of sigmasub(TT) and sigmasub(TL) seems possible. The first measurement of the Q^2 dependence of high psub(T) jet production was presented. Both high psub(T) and high Q^2 help in extracting the Born process γγ -> qanti q by suppressing competing processes. Progress has been made in measuring the photon structure function F_2. The data available have increased from the original 110 PLUTO events in 1981 to well above 2000 events from five experiments. The Q^2 limit accessible has grown from 15 GeV^2 to about 200 GeV^2. A proper unfolding method which converts the measured event distribution into a structure function F_2 (x, Q^2) has been presented.

19281 (DESY—83-063) Observation of inclusive eta production in e^+e^- annihilation at c.m. energies of 34 GeV. Dietrich, G.; Elsen, E.; Heinzelmann, G.; Kado, H.; Meier, K.; Petersen, A.; Schneekloth, U.; Weber, G.; Bethke, S.; Dieckmann, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750506.

The inclusive production of eta mesons at c.m. energies around 34 GeV has been studied for e^+e^- annihilation into hadrons. The average number of eta-mesons per event is found to be 0.72 +- 0.10 (stat.) +- 0.18 (syst.). The abundance of eta's is studied as a function of event shape parameters and it is compared to the corresponding π^0 rates.

19282 (DESY—83-064) Differential cross sections for $\gamma\gamma$->panti p in the C.M. energy range from 2.0 to 3.1 GeV. Althoff, M.; Braunschweig, W.; Gather, K.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Peise, G.; Rimkus, J.; Rosskamp, P.; Sander, H.G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750507.

Exclusive production of proton-antiproton pairs by two photon scattering at c.m. energies between 2.0 GeV and 3.1 GeV has been measured with the TASSO detector at the e^+e^- storage ring PETRA. The angular distribution is flat within the accepted c.m. angular range vertical strokecosTHETAsup(*)vertical stroke<=0.7. The integrated cross section (vertical strokecosTHETAsup(*)vertical stroke<=0.6) drops from about 4 nb at 2 GeV to less than 0.5 nb above 3 GeV. For the two-photon production of the etasub(c)(2984) and its subsequent decay into proton-antiproton the upper limit GAMMA(etasub(c)->$\gamma\gamma$)xB(etasub(c)->panti p)<0.32 keV (95% c.l.) is found.

19283 (DESY—83-066) Inclusive γ and π^0 production in e^+e^- annihilation at 14, 22, and 34 GeV c.m. energy. D'Agostini, G.; Apel, W.D.; Engler, J.; Fluegge, G.; Fries, D.C.; Fues, W.; Gamerdinger, K.; Hopp, G.; Kuester, H.; Mueller, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750505.

We have measured the scale invariant inclusive photon and π^0 cross sections at W = 14, 22 and 34 GeV. A comparison with π^{+-} data shows no significant difference between neutral and charged pion production. Comparing the integrated cross sections in the x range $0.15 < x < 1.0$ we observe a considerable decrease from 14 GeV to 34 GeV with a statistical significance of 1.5 standard deviations. This is compatible with the expectations for scaling violations from QCD.

19284 (DESY—83-067) Precision measurement of the ν' meson mass. Barber, D.P.; Bremer, D.H.; Kewisch, J.; Lewin, H.C.; Limberg, T.; Mais, H.; Ripken, G.; Rossmanith, R.; Schmidt, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 12p. (CONF-8308101—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750253.

From International symposium on lepton and photon interactions at high energies; Ithaca, NY, USA (4 Sep 1983).

The e^+e^--storage ring DORIS II provides polarized beams with polarizations up to 80% in the energy range of the ν' meson. The method of resonance depolarization allows the average beam energy to be determined to a precision of +- 0.1 MeV. An energy scan of the hadronic cross section over the resonance range with the detectors ARGUS and Crystal Ball determines the Y' mass to be (10023.1 +- 0.4 +- 0.5) MeV.

19285 (DESY—83-071) Observation of Ξp, anti Ξ^- production in e^+e^- annihilation. Althoff, M.; Braunschweig, W.; Gather, K.; Kirschfink, F.J.; Luebelsmeyer, K.; Martin, H.U.; Preise, G.; Rimkus, J.; Rosskamp, P.; Sander, H.G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750866.

We present evidence for the production of Ξ^-, anti Ξ^- in e^+e^- annihilation into hadrons. Our measurement yields: 0.026 +- 0.008 (stat.) +- 0.009 (syst.) Ξ^-, anti Ξ^- per hadronic event at W proportional 34 GeV.

19286 (DESY—83-076) Resonance production in $\gamma\gamma$ reactions. Olsson, J.E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750891.

Experimental results on the exclusive production of resonances in $\gamma\gamma$ collisions are reviewed. These include new measurements of the radiative widths of the pseudoscalar (eta,eta') and the tensor mesons (f, A_2, f'). A comparison of these results with SU(3) is made. Upper limits for other states than f in $\gamma\gamma \to \pi\pi$ are given. The searches for $\gamma\gamma$ production of the states iota and theta as well as etasub(c) are presented and upper limits are given. Finally a limit is given for the rare decay $f \to \pi^+\pi^-2\pi^0$.

19287 (DESY—83-079) Test of fragmentation models by comparison with 3-jet events produced in $e^+e^- \to$ hadrons. Dietrich, G.; Elsen, E.; Heinzelmann, G.; Kado, H.; Meier, K.; Petersen, A.; Schneekloth, U.; Weber, G.; Bethke, S.; Dieckmann, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750889.

The energy flow and particle flow distributions of planar 3-jet events produced in $e^+e^- \to$ hadrons at c.m. energies between 29.5 and 36.4 GeV have been interpreted in terms of the reaction $e^+e^- \to$ qanti qg and compared with the distributions calculated from two different fragmentation schemes, one based on independent parton fragmentation, the other one on fragmentation along colour flux lines. The particle density at angles between the two highest energy jets is found to decrease more strongly with increasing transverse mass of the particles than the particle density at angles between any of these jets and the lowest energy jet. The high momentum particles within the two most energetic jets are emitted at larger angles with respect to the lowest energy jet than the average particles. These observations are well reproduced by fragmentation along colour flux lines, but not by independent parton fragmentation.

19288 (DESY—83-081) Measurement of the reaction $\gamma\gamma \to \pi^+\pi^+\pi^-\pi^-$ at PETRA. Achterberg, O.; D'Agostini, G.; Apel, W.D.; Engler, J.; Fluegge, G.; Forstbauer, B.; Fries, D.C.; Fues, W.; Gamerdinger, K.; Henkes, T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750900.

We have determined the cross section for $\gamma\gamma \to \pi^+\pi^+\pi^-\pi^-$ in a way free of assumptions about the relative contributions from rho^0rho^0, $rho^02\pi$ and 4π (uncorrelated phase space). We find a sharp onset above threshold and a rather high cross section of about 200 nb around $W_{sub}(\gamma\gamma) = 1.5$ GeV which consists to about 40% of rho^0rho^0 production with sizeable contributions from $rho^02\pi$ and 4π (P.S.). The total cross section as well as the rho^0rho^0 content fall rather fast at higher c.m. energies. Attempts to explain this behaviour in terms of production of known resonances are not successful so far. The angular distributions do not show any significant structure pointing to resonance formation in the 4π-system. Only the rho^0-meson is observed in the moment analysis. The decay distributions of the rho^0 for forward produced rhos are fairly consistent with helicity conservation of the produced rhos in accordance with the VDM picture.

19289 (DESY—83-084) Measurement of the muon pair asymmetry in e^+e^- annihilation at $\sqrt{s} = 34.7$ GeV. Berger, C.; Genzel, H.; Lackas, W.; Pielorz, J.; Raupach, F.; Wagner, W.; Floelo, L.H.; Klovning, A.; Lillestoel, E.; Olsen, J.M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750902.

The reaction $e^+e^- \to \mu^+\mu^-$ has been studied with the PLUTO detector at the c.m. energy of 34.7 GeV, based on an inte-

grated luminosity of 46 pb^{-1}. The total cross section agrees with QED predictions, and the corresponding lower limits for the Λsub(+) and Λsub(-) QED cutoff parameters are 267 and 126 GeV respectively (95% c.l.). A forward-backward asymmetry parameter A = -(13.4 +- 3.1 +- <1)% is observed, which is in agreement with the standard model, as well as with other PETRA results obtained at the same energy.

19290 **(DESY—83-085) Latest results on hadron production at PETRA.** Rykaczewski, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750901.

Some of the prime objectives of investigations of hadron production via e^+e^- annihilation are the searches for new quark flavors and studies of electroweak effects due to the interference of virtual γ- and Z^0-exchange. By measuring the total hadronic cross-section R and the structure of hadronic events, we exclude the continuum production of top quarks up to c.m. energies of more than 40 GeV. Using the R-measurements we determine sin²thetasub(w) at high Q^2. Analyses of hadronic final states produced by two-photon interactions lead to results on meson resonance production and the photon structure function F_2.

19291 **(EFI—576(63)-82) Possibility of performing twice polarized pion photoproduction experiments of the type G and H at Yerevan synchrotron.** Vartapetyan, G.A.; Kazaryan, A.P.; Manukyan, Zh.V.; Sirunyan, A.M. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700688.

At Erevan synchrotron the performance of twice polarized-meson photoproduction experiments in the energy range of perturbation of nuclear resonances N is designed. In these experiments a beam of linearly polarized photons will be used polarized proton target (PPT) that can alter the direction of the proton polarization vector along three mutually perpendicular axes. The measurement technique of polarization parameters are described, peculiarities of the investigations by means of PPT, connected with the presence of magnetic field near the magnet, are considered. The influence of the PPT field on particle trajectories in the experiment with a magnetic spectrometer is investigated based on the Monte Carlo calculations. In the paper the setup parameter corrections for the spectrometer are defined.

19292 (INS-J—164, pp 63-70) **Experimental indications of composite structure of leptons and quarks.** Yasue, Masaki (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

Some answers are given to the question, "Where and how could we find a clear evidence for the possible sub-structure of leptons and quarks.

19293 **(JINR—E-1-82-760) Polarization of Λ produced by neutrons with an energy of approximately 40 GeV on carbon nuclei.** Aleev, A.N.; Arefiev, V.A.; Balandin, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 9p. (CONF-820718—50). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700689.

From 21. international conference on high energy physics; Paris, France (26 Jul 1982).

The polarization of Λ deg inclusively produced by neutrons on carbon at an average neutron energy of approximately 40 GeV has been measured. The Λ deg polarization increases with increasing of transverse momenta achieving 30% for about 0.8 GeV/c. The experiment has been performed using the BIS-2 spectrometer at the Serpukhov accelerator. The results of the experiment are in agreement with results of polarization measurement of Λ deg produced by protons.

19294 (KEK—81-23, pp 68-72) **Physics of two-nucleon system by polarized beam and polarized targets.** Hoshizaki, Norio (Kyoto Univ. (Japan). Faculty of Engineering). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8103183—).

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

Recent progress on the studies of dibaryons is reviewed. The pp resonances $^1D_2$ and $^3F_3$ have been almost established by the recent measurement of the difference of longitudinal polarization total cross sections at SIN and LAMPF and the difference of transverse polarization total cross sections at TRIUMF. The Argand diagram obtained by several groups also supported the presence of these resonances. Apart from these, $^3P_2$ and $^3F_4$ resonances were suggested by the Argand diagrams, and $^3D_2$ and $^1P_1$ were predicted at low energy theoretically. It is favorable to regard the dibaryons as the new state of hadrons. This was supported by the indication of the existence of the $^1F_3$ resonance with the minus parity at M = 2.21 GeV, which was suggested by the partial wave analysis of np world data. This resonance was supported by the measurement of the difference of longitudinal polarization total cross sections (I=O) at ANL and np reaction cross section (I=O) by the Freiburg group. The measurement of the differential cross section of np scattering in the forward direction was recommended as a proposal at KEK. The perfect experiment of n-p scattering using polarized beam available in future is recommended.

19295 (KEK—81-23, pp 36-40) **Test of neutrino mass by $\pi^0 \to \nu(\text{antin}\nu)$ decay.** Kurokawa, Shin-ichi (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Mar 1982. NTIS (US Sales Only), PC A05/MF A01. (CONF-8103183—).

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

The possibility of detecting heavy neutrino mass by measuring the branching ratio of $\pi^0 \to \nu(\text{antin}\nu)$ decay is discussed. Clean π^0s can be obtained from $\pi^0\pi^+$ decay of kaons which are available, at present, from K3 beam at KEK. If a new kaon beam facility which is optimized for stopping kaons is constructed, the rate of stopping kaons is expected to be 2 x 10^8 K^+ stop/3 x 10^{12} ppp. Charged pions from K decay are identified by their range, which are determined by the range counters that cover 20% of solid angle, and by observing the decay chain $\pi^+ \to \mu^+ \to e^+$. To veto gammas and electrons from π^0, Pb-glass Cerenkov counters are arranged inside the range counters. The rest of solid angle is filled with bismuth germanate (BGO) crystals which are also used to veto gammas and electrons. The counting rate is estimated to be 2400 π^0/pulse, and it is enough for the detection of the decay with the branching ratio 10^{-9}. Main backgrounds come from the inefficiency of vetoing the decay products of π^0s and misidentification in $K^+ \to \mu^+\nu\gamma$ events. The rejection efficiency for both backgrounds is estimated to be 10^{-10}.

19296 (KEK—81-23, pp 41-45) **Experiment searching for rare decay modes of K^+ meson.** Shinkawa, Takao (Tokyo Univ. (Japan). Faculty of Science). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8103183—).

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

The preliminary results of the experiment searching for rare decay modes of kaon decay, including $K^+ \to \pi\nu(\text{antin}\nu)$, $K^+ \to \pi^+$ + axion and $K^+ \to \pi^+\gamma\gamma$, are reported. Kaons from K3 beam at KEK were stopped at target counters consisting of seven piles of scintillation counters, and identified by TOF method and by measuring dE/dX just before stopping. Pions and muons were identified by observing the decay chain $\pi^+ \to \mu^+ \to e^+$, and their momenta were determined by measuring their ranges. Nine piles of Pb-glass Cerenkov counters were used to observe gammas. The data consisted of 1.6 x 10^{10} $K^+ \to \pi^+\nu(\text{antin}\nu)$ mode and 4.1 x 10^8 $K^+ \to \gamma\gamma$ mode. Analysis was completed about 1/3 of $K^+ \to \pi^+\nu^+\nu(\text{antin}\nu)$ mode and 15% of $K^+ \to \pi^+\gamma\gamma$ mode. The preliminary results gave the upper limit of the branching ratio at 4.2 x 10^{-7} for $K^+ \to$ $pi^+\nu(\text{antin}\nu)$, 6.3 x 10^{-9} for $K^+ \to \pi^+$a. and 3.9 x 10^{-8} for $K^+ \to \pi^+\gamma\gamma$. These values are expected to be lowered after completing the analysis of the whole data.

19297 (KEK—81-23, pp 76-81) **P(up) + P(up) scattering experiment at high transverse momentum using polarized proton beam and polarized targets.** Nakanishi, Tsutomu; Horikawa, Naoaki (Nagoya Univ. (Japan). Faculty of Science). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8103183—).

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

Two types of experiments using polarized proton beam and polarized targets are recommended. The Ann in p(up)n(up)→pn and p(up)p(up)→pp processes should be measured at first in order to see whether the scaling still holds, and to know what the flavor dependence in p(up)p(up) and p(up)n(up) scattering is. At the same time, the inclusive processes p(up)n(up)(p(up)p(up))→hX with h = π^{+-}, K^{+-}, p also are measured. Second experiments proposed are the measurements of All in p(polarized)p(polarized)→pp and p(polarized)n(polarized)→pn and their corresponding inclusive processes. The feasibilities of these experiments are discussed. Polarized targets with p(deuteron) >= 40%, p(proton) >= 90% are available. Polarized proton beam with a maximum energy 12 GeV is eagered. The spectrometer of the type used by Krisch et al. is suitable for the high intensity beam with 10^8 - 10^{10} pps, while the type by Yokosawa et al. is suitable for the low intensity case with 10^6 - 10^7 pps. The machine time is estimated to be about 1.5 months for the former case and 3 months for the latter one.

19298 (MPI-PAE/Exp.El.—122) **Lifetime measurement of D mesons with a silicon vertex detector.** Seebrunner, H.J. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Oct 1983. 4p. (CONF-830718—). Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.).

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

The measurement of the lifetime of the D mesons produced inclusively in 200 GeV π^- Be interactions and decaying into $K\pi$, $K\pi\pi$, and $K\pi\pi\pi$ is described.

19299 (PITHA—80/18) **High transverse momenta and jet structures in strong interactions.** Eggert, K. (Technische Hochschule Aachen (Germany, F.R.); Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 1980. 124p. (In German). Technische Hochschule Aachen (Germany, F.R.).

The present thesis describes the status of the experimental results up to 1978 and interprets them in the parton model which is suitable for this in an especially simple way. The interest is concentrated on results from the proton storage rings in the European Nuclear Research Center CERN and from the 300-GeV Accelerator in the Fermi National Institute near Chicago (FNAL). At this two accelerators the highest transverse momenta were measured. First the quark-parton model and some of its successes in the lepton-nucleon scattering are described. In chpt. 3 the fragmentation of the quarks in a hadron jet is treated. Pure jets without disturbing background from other hadrons can be otpically studied in the electron-positron annihilation. These jets are compared with those in the lepton-nucleon scattering and in hadronic interactions. In chpt. 4 a survey about the experiments is given, and the difficulties in the definition of a jet in hadronic interactions are indicated. Chpt. 5 deals with the inclusive transverse momentum spectra. The chapters 6 and 7 deal with the jet structures in proton-proton interactions.

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REFER ALSO TO CITATION(S) 19239, 19287, 19362, 19363, 19363, 19363, 19366, 19373, 19394, 19427

19300 (BONN-HE—83-18) **Particle production in panti p interactions at 540 GeV and strange quark suppression.** Boeckmann, K. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Sep 1983. 9p. (CONF-8305119—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750894.

From 4. Warsaw symposium of elementary particles; Kazimierz, Poland (30 May 1983).

Strange quark suppression at Collider energies is studied in data on particle production from the UA5 streamer chamber experiment. The value of the strangeness suppression factor lambda=0.39+-0.06 is compared with results from lower energies.

19301 (CERN—83-05, pp 145-186) **Applications of QCD.** Landshoff, P.V. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). 22 Jun 1983. NTIS (US Sales Only), PC A14/MF A01. (CONF-8209205—).

From CERN school of physics '82 meeting; Cambridge, UK (1 Sep 1982).

The author describes the application of quantum chromodynamics to deep inelastic lepton scattering, the Drell-Yan process, e^+e^--annihilation, $\gamma\gamma$-physics, large psub(T) processes, and wide angle quark-quark scattering. Furthermore higher order terms are considered.

19302 (CONF-8309220—1) **Quark distributions in nuclei: results from lepton probes.** Vary, J.P. (Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics). 1983. Contract AC02-82ER40068. 25p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007430.

From Quark matter '83 workshop; Upton, NY, USA (1 Sep 1983).

Deep inelastic lepton scattering from nuclei indicates that quark-parton distributions are significantly different from the distributions in isolated nucleons. The EMC and SLAC data on iron and deuterium targets show enhanced and suppresed scattering for kinematic regions where Bjorken $x < 1$. In addition, the SLAC data on ^{3}He show strong enhancement over results with conventional nuclear theory for $x > 1$. These data and recent model interpretations are summarized. Detailed comparisons with the data are presented for the quark cluster model. 53 references.

19303 (DESY—83-043) **Nonabelian structure of QCD in quarkonium decays.** Streng, K.H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750246.

We investigate beam-event correlations and transverse momentum structures for 4 jet and photon plus 3 jet decays of orthoquarkonia. Predictions depend significantly on the gluon or quark origin of the hadronic jets and on the nonabelian nature of QCD.

19304 (DESY—83-044) **Higher order QCD corrections to the three-jet cross sections: bare versus dressed jets.** Kramer, G.; Schierholz, G.; Gutbrod, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750245.

We report results for the three-jet cross section to order $\alpha sub(s)^2$ using a jet resolution criterion depending on the jet mass and study the sum of three- and four-jet cross sections in $\sigma(\alpha sub(s)^2)$ as a function of the resolution parameters in order to obtain the limit of infinite resolution.

19305 (DESY—83-060) **Model dependence of the electromagnetic corrections to lepton pair production in electron-positron collisions.** Boehm, M.; Hollik, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750251.

The electromagnetic radiative corrections to e^+e^--annihilation into lepton pairs are calculated including hard photon bremsstrahlung in the standard and extended electroweak models. For $\sqrt{s}$ = 38 GeV we find for the standard model, that the radiative corrections to Z-exchange reduce the charge asymmetry up to 1% which is mainly caused by the virtual and soft photon parts of the corrections. For models with a higher forward-backward asymmetry the situation is found to be quite similar.

19306 **(DESY—83-061) Calculation of the glueball mass-spectrum of SU(2) and SU(3) non-abelian lattice gauge theories II: SU(3).** Ishikawa, K.; Sato, A.; Schierholz, G.; Teper, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 77p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750869.

We calculate the glueball mass spectrum in the SU(3) lattice regularized gauge theory. We find four light glueballs: the 0^{++}, 2^{++}, 0^{-+}, and, most interestingly from the experimental point of view, the oddball 1^{-+}. We calculate the 0^{++} and 2^{++} masses over a range of β values and find that both states conform to continuum renormalization group behaviour to a very significant degree. The question of metastable states and temperature is addressed in detail. Finally we discuss and resolve contrary claims in the recent literature.

19307 **(DESY—83-068) Theory of jets in electron-positron annihilation.** Kramer, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 209p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84750867.

The author presents a review about the theoretical description of jets produced in e^+e^- annihilation. After general considerations of the fragmentation of quarks and gluons into jets the process is discussed in the framework of perturbative quantum chromodynamics.

19308 **(DESY—83-070) Energy-energy correlations in e^+e^- annihilation.** Barreiro, F.; Ali, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750865.

We calculate energy-energy correlation (EEC) upto O(αsub(s))^2 in perturbative Quantum Chromodynamics, QCD. The effects of heavy quark masses and experimental resolution in the spirit of Sterman-Weinberg on the EEC functions are also calculated to the same order. We find that the EEC function is sensitive to both the radiative corrections and experimental resolution criterion. The asymmetric EEC function is, in contrast, stable with respect to both the radiative and power corrections in perturbation theory. It is argued that both the data and perturbation theory indicate substantial non-perturbative power corrections to the EEC but modest effects in the asymmetry for Q >= 25 GeV. We show that limited-psub(T) fragmentation models without long range colour-correlations are in agreement with the expectations and data. A phenomenological analysis of the PETRA/PEP data is performed to determine the QCD scale parameter. We determine $\Lambda = 120\text{sub}(-47)^{+60}$ MeV with no power corrections, and $\Lambda = 168\text{sub}(-40)^{+60}$ MeV if limited-psub(T) fragmentation effects are included. The small non-perturbative power correction to the asymmetric EEC is a characteristic feature of the limited-psub(T) independent-parton-fragmentation models and is testable at PETRA energies.

19309 **(DESY—83-072) Meson spectrum in quenched QCD on a 16^4 lattice.** Hasenfratz, P.; Montvay, I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750868.

The masses of pseudoscalar and vector mesons and their radial excitations are measured in to quenched approximation to QCD by a 32sup(nd) order numerical hopping parameter expansion on a 16^4 lattice. Scaling behaviour, finite size effects and the influence of statistics are studied.

19310 **(DESY—83-078) Decays Psub(c) -> VP in the group theoretical and quark diagrammatic approaches.** Tuan, S.F.; Xiaoyuan Li. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750888.

Decays of charmed meson into one vector meson and one pseudoscalar meson Psub(c) -> VP in both the group theoretical and quark diagrammatic approaches are considered. A complete decay amplitude analysis is given. The present available experimental data can be accomodated if the contributions from exotic final states and exotic piece of weak Hamiltonian are also taken into account.

19311 **(DESY—83-090) Remarks about the counting of anti νν generations using the $e^+e^- \to \gamma Z^0$ process.** Bartels, J.; Schwarz, A.; Fridman, A.; Wu, T.T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 17p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84750905.

In the present note we further explore the possibility of measuring the number of anti νν generations by means of $Z^0 \to$ anti νν decays. We investigate in particular the case where the radiative transitions $e^+e^- \to \gamma Z^0$ are studied on the Z^0 resonance itself. The various background reactions are discussed as well as the statistical significance that can be obtained for an additional anti νν generation.

19312 **(DESY—83-092) Proton capture by magnetic monopoles.** Olaussen, K.; Olsen, H.A.; Oeverboe, I.; Osland, P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750896.

In the Kazama-Yang approximation, the lowest monopole-proton bound states have binding energies of 938 MeV, 263 keV, 105 eV, and 0.04 eV. The cross section for radiative capture to these states is for velocities $\beta = 10^{-5} - 10^{-3}$ found to be of the order of $10^{-28} - 10^{-26}$ cm^2. For the state that has a binding energy of 263 keV, the capture length in water is 171 x $(\beta/10^{-4})$sup(0.48) m. Observation of photons from the capture process would indicate the presence of monopoles.

19313 **(DESY—83-093) Strong evidence for spontaneous chiral symmetry breaking in (quenched) QCD.** Barbour, I.M.; Gibbs, P.; Schierholz, G.; Teper, M.; Gilchrist, J.P.; Schneider, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 20p. (LAPP-TH—87). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750897.

We calculate the chiral condensate <anti psipsi> for all quark masses using Kogut-Susskind fermions in lattice-regularized quenched QCD. The large volume behaviour of <anti psipsi> at small quark masses demonstrates that the explicit U(1) chiral symmetry is spontaneously broken. We perform the calculation for $\beta = 5.1$ to 5.9 and find very good continuum renormalization group behaviour. We infer that the spontaneous breaking we observe belongs to continuum QCD. This constitutes the first unambiguous demonstration of spontaneous chiral symmetry breaking in continuum quenched QCD.

19314 **(DESY—83-094) Meson and baryon masses for light Kogut-Susskind quarks on a large lattice.** Schierholz, G.; Teper, M.; Gilchrist, J.P.; Schneider, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 18p. (LAPP-TH—88). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750898.

We calculate meson and baryon masses in quenched QCD for the small quark masses of phenomenological interest on a 10^3x16 lattice. We use Kogut-Susskind fermions which possess an explicit continuous chiral symmetry. We verify that this chiral symmetry is spontaneously broken and that for the physics involved our lattice is effectively of infinite volume at the quark masses we calculate. We verify msub(π)^2 proportional msub(q), which is what one expects for a Goldstone pion. For Asub(mom) = 200 MeV, which appears to be the consistent scale of quenched QCD, we find msub(q) approx.= 7 MeV and the hadron masses msub(rho) = (730 +- 90) MeV, msub(A1) = (1190 +- 90) MeV, msub(epsilon) = (660 +- 50) MeV and msub(N) = (920 +- 100) MeV. We also extract fsub(π)approx.=134 MeV. In physical units our lattice is 3 fermi across.

19315 **(DESY-L-Trans—281) Rare decays of heavy quarks and leptons.** Volkov, G.G.; Liparteliani, A.G.; Monich, V.A.; Nikitin, Yu.P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 35p. Deutsches Elektronen-Synchrotron Hamburg (Germany, F.R.).

Translated from Russian. Also published as report IFVE-ONF/FTO-PK--82-181.

The amplitudes of rare processes with heavy (t,b,c)-quarks and tau-leptons are calculated in detail.

19316 **(DOE/ER/10528—T2) Pole model prediction for weak and electro weak decays of hadrons. Progress report, May 1, 1983-April 30, 1984.** Munczek, H.J.; McKay, D.W. (Kansas Univ., Lawrence (USA)). 27 Feb 1984. Contract AC02-79ER10528. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007691.

Portions are illegible in microfiche products.

Progress is briefly described on the following topics: a chiral non-linear Lagrangian model, research on the ground state Q anti Q mass spectrum, and chiral anomalies. (WHK)

19317 **(EFI—581(68)-82) Relativistic quark model and behaviour of the meson electromagnetic form factors at small and intermediate momentum transfer Q^2.** Bagdasaryan, A.S.; Esaybegyan, S.V.; Ter-Isaakyan, N.L. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700681.

In a model of hadrons composed of relativistic quarks a description of meson static characteristics and pion electromagnetic form factor in the range of small and intermediate values of momentum transfer $0 <= Q^2 < 6$ $(GeV/c)^2$ have obtained. It is shown that in such a model the data available on the pion electromagnetic form factor may be described basing on a simplest quark without gluon exchange. The contribution of a one-gluon exchange diagram in such a model cannot exceed 30%.

19318 **(HD-THEP—83-2) Non-perturbative effects due to quark condensate and application to the baryon $\Lambda(1405)$.** Liu Jueping. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). Jan 1983. 89p. Library of Heidelberg Univ. (Germany, F.R.).

We investigate non-perturbative effects due to quark condensates by approximating the generating functional. The mixing of various composite operators for baryons has been analysed. A formula about the symmetric sum of products of Dirac matrices is derived and used to simplify the Fourier transformations of the propagator of a composite operator. In the application to the baryon SU(3)-flavour-singlet $\Lambda(1405)$ we construct the most general composite operator from 3 and 5 quark fields and at most a single derivative. In particular we include compounds composed of 4 quarks and an antiquark. The optimal operators for different mixing schemes were investigated. It is found that the operators consisting of 3 quarks and an quark-antiquark pair both in a color-singlet and flavour-octet representation are most important.

19319 **(IFUSP-P—351) Completely computable p-n mass difference.** Kimel, I. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700690.

Weinberg-'t Hooft mechanism for rendering mass differences finite, in conjunction with a new representation for these mass differences make it possible to compute Δ = Mp-Mn. The value obtained is somewhat low but with the right sign.

19320 **(IFUSP-P—368) New formula for proton-neutron mass difference.** Kimel, I. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Oct 1982. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700691.

A new formula allowing, the computation of the proton-neutron mass difference without the knowledge of the substraction function in the dispersion integral is presented. The Born terms contribute with the correct sign. The integral over the deep-inelastic region is finite whenever the Weinberg-'t Hoof mechanism is operative and gives a small value. The net result is in very good agreement with the experimental value.

19321 (INIS-mf—8156, pp 35-41) **Large amplitude neutrino oscillations with Majorana mass eigenstates.** Bilenky, S.M.; Pontecorvo, B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1982. NTIS (US Sales Only), PC A19/MF A01. (CONF-820675—Vol.1).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The problem of nonvanishing neutrino mass and its origin is discussed. The possible Majorana mass of neutrinos might be indicated by detection of large amplitude and probably large oscillation length neutrino oscillations which might be expected naturally in theoretical schemes using Majorana mass terms. The recent and near future neutrino oscillation experiments are analysed concerning the detectable Majorana masses assuming different theoretical schemes, e.g. coexistence of Majorana and Dirac mass terms.

19322 (INIS-mf—8703, pp vp) **Electromagnetic form factors and multichannel Jost matrix.** Krupa, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19323 (INIS-mf—8703, pp vp) **Direct calcualtion of electromagnetic form factors in the coupled channels formalism.** Krupa, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19324 (INIS-mf—8703, pp vp) **Baryon production in e^+e^- and p-barp collisions and the quark-parton model.** Lichard, P.; Masejova, A.; Pisut, J. (Komenskeho Univ., Bratislava (Czechoslovakia). Matematicko-Fyzikalna Fakulta). 1981. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19325 (INIS-mf—8703, pp vp) **Elastic hadron scattering in impact parameter representation.** Kundrat, V.; Lokajicek, M. Jr.; Lokajicek, M.V. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19326 (INIS-mf—8703, pp vp) **Six-quark model and some of its applications.** Toth, L. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Prirodovedecka Fakulta). 1981. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19327 (INIS-mf—8703, pp vp) **$N \rightarrow \Lambda^0 K^0$ dissociation process.** Novak, M. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19328 (INIS-mf—8703, pp vp) **Froissart bound for complex scattering angles.** Chaichian, M. (Helsinki Univ. (Finland). Dept. of High Energy Physics); Fischer, J. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav); Nelipa, N.F. (Moskovskij Gosudarstvennyj Univ. (USSR)); Vrkoc, I. (Ceskoslovenska Akademie Ved, Prague. Matematicky Ustav). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19329 (INIS-mf—8703, pp vp) **Angular analysis of light hypernuclei production.** Zofka, J.; Sotona, M.; Majling, L. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky); Fetisov, V.N. (AN SSSR, Moscow. Fizicheskij Inst.). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19330 (INIS-SU—196, pp 39-40) **Consequences of the dispersion theory for the D → eνKsup(*)decay form factors.** Barannik, V.P.; Korzh, A.P.; Kulish, Yu.V. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Width of D → eνk decay as well as the spectrum of the formed electrons are calculated. Form factors model based on dispersion relations and current algebra is suggested for numerical calculations. The dependence on leptonic decay constants for K*-, F-, Fa- and D-mesons of electron spectrum width and form is analyzed.

19331 (INIS-SU—196, pp 37-38) **A′$_1$-meson in the tau →νrhoπ decay.** Barannik, V.P.; Kulish, Yu.V. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Heavy lepton decay tau → νrhoπ is studied using the methods of current algebra and with account of partial preservation of axial current. Asub(I)sup(1)-meson with the mass of about 1650 MeV is supposed to contribute to the amplitude of this decay besides the well-known Asub(I) meson. In this case the agreement with the experimental data on distribution by the invariant mass of the rhoπ-system is essentially improved especially at square values of transmitted pulse close to the maximum.

19332 (INIS-SU—196, pp 28-30) **Polarization effects in the e$^-$d → e$^-$pn process.** Gakh, G.I.; Rekalo, M.P. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Hadron tensor describing polarization effects in the reaction of deutron electrodisintegration is calculated for the following experimental conditions: recoil nucleon is polarized, deutron target is polarized (only vector polarization is taken into account), the recoil nucleon and the target are polarized simultaneously. The calculations are conducted in pulse approximation with account of relativistic corrections using the virtual nucleon density matrix formalism.

19333 (INIS-SU—196, pp 24-27) **Electromagnetic mechanism of the Δ-isobar production at πN, kN, NN collisions.** Merenkov, N.P. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

Cross sections and density matrix elements of Δ-isobar for different reaction channels of Δ-isobar production in πN-, Kn- and NN-interactions in a high energy range are determined within the frames of the model accounting for photon and vacuum pole exchange induced by radiative corrections.

19334 (INS—455) **Dynamical and phenomenological aspect of subquark models.** Yasue, Masaki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Aug 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700683.

A dynamical and phenomenological aspect of subquark models is briefly reviewed. Various lower bounds on compositeness scale of the leptons and quarks as well as its possible upper bound are estimated. A chiral symmetry is imposed on the interaction of massive spinor and scalar subquarks with a composite fermion in a "dynamical subquark model of pregauge interactions". As a result, the lower bound on the subquark mass can be in principle as low as 10 GeV as far as the anomalous magnetic moments of the leptons and quarks are concerned. Expected experimental signals due to the light subquarks are listed.

19335 (INS-J—164, pp 9-15) **New idea of the-quark-lepton correspondence.** Koide, Yoshio (Shizuoka Women's Univ.). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

The Cabibbo mixing is understood as a "π-eta mixing" in composite quarks. Possible models are discussed. The rightest place where subquark models prove their worth is the "generation" problem. Usually generations of quarks and leptons are considered as (νsub(e), e$^-$; u, d), (νsub(μ), μ$^-$; c, s), (νsub(tau), tau$^-$; t, b), and so on, where leptons (νsub(e), e), (νsub(μ), μ), (νsub(tau), tau), and so on, have the same "generation-structures" as quarks (u, d), (c, s), (t, b), and so on, respectively (i.e. "direct" lepton-quark correspondence). In this talk, however, I would like to assert that quarks and leptons are not "brothers", but "cousinhood" (i.e. "indirect" lepton-quark correspondence), so that the origin of the quark-generations may differ from that of the lepton-generations.

19336 (INS-J—164, pp 16-23) **Generations for light composite quarks and leptons.** Yamawaki, Koichi; Yokota, Terufumi (Nagoya Univ. (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

We present an SU(3) subcolor composite model in which quarks, leptons and technifermions are subcolor singlet composites made out of three kinds of massless elementary fermions t, c and w, each carrying technicolor, color and weak gauge interactions, respectively. Discrete symmetries, remnant of the U(1)sub(A) of the original Lagrangian, are responsible for the masslessness of all the quarks and leptons and give the precise meaning of the generations. The model exhibits three generations for quarks and leptons. Small but non-zero masses of them are produced by the technicolor condensate of the composite technifermions, which may lead to the non-trivial Cabibbo mixing. Proton decays are all forbidden at the mass scale of the subcolor dynamics.

19337 (INS-J—164, pp 24-30) **B-L and subquark model.** Ohba, I.; Okano, K.; Yamanaka, Y. (Waseda Univ., Tokyo (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

We propose a composite model for quarks and leptons which are composed of S-bar SS and S-bar S-bar S-bar, respectively. Here S is J = 1/2 fermion with B-L = 1/3. We discuss nucleon decays which can have characteristic decay modes in comparison with naive GUT.

19338 (INS-J—164, pp 43-52) **Weinberg sum rules and the mass of composite quarks.** Yamawaki, Koichi (Nagoya Univ. (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

It is shown that the dynamically generated quark mass in QCD is responsible for the convergence of the non-trivial Weinberg sum rules in the chiral symmetric limit. Although the sum rules are plagued by the explicit chiral symmetry breaking, they may be viable if the current quark mass is also soft enough, namely, power damping. A possible mechanism for softening the current quark mass is suggested in a recently proposed composite model for quarks and leptons.

19339 (INS-J—164, pp 59-62) **Non-renormalizable field theories and pointlike composites.** Akama, Keiichi (Saitama Medical College, Moroyama (Japan)). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

19340 (INS-J—164, pp 74-86) **Conditions for realistic sub-lepton/quark models.** Bando, Masako (Kyoto Univ. (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

The composite lepton/quark models are examined in view of the conditions which are required by phenomenological facts.

19341 (INS-J—164, pp 53-58) **Yang-mills couplings and $e^+e^- \rightarrow W^+W^-$.** Hikasa, Ken-ichi (Tokyo Univ. (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

Unitarity correction to the $e^+e^- \rightarrow W^+W^-$ cross section in non-gauge theories is calculated. Comparison with the gauge cross section is made.

19342 (KEK—81-12, pp 53-75) **Report on the work of the 'Monte Carlo Event Generation' subgroup.** Abe, K. (Tohoku Univ., Sendai (Japan)). Oct 1981. NTIS (US Sales Only), PC A04/MF A01. (CONF-8107121—).

From 1. workshop on detectors for TRISTAN positron-electron physics; Oho, Ibaraki, Japan (9 Jul 1981).

The work of the Monte Carlo Event Generation includes the preparation of programs, jet simulation, track generation in chambers, and the pattern recognition of tracks and track fitting. Some general results from the jet simulation by Ali et al. are given. The total energy used was 60 GeV, and the top quark mass was assumed to be 25 GeV. The multiplicity of charged particles and photons is shown. The multiplicity increased with the number of jets. The energy spectra and the trajectories of charged particles and photons were obtained. The distribution of the opening angle of any two photons is also presented. The track generation program used is GEANT from CERN. This program was adapted to the KEK computer. Pattern recognition and track fitting are based on the tracking device. The program considered was that by DELCO group at SLAC. The tracking device consists of a MWPC and a cylindrical drift chamber with wires along the beam direction Z and wires inclined at a stereo angle. Some comments on vertex detectors are given.

19343 (KEK—81-23, pp 5-10) **Possibility of production of Q^2 anti Q^2 Q^4 anti Q, and Q^6 states from hydrogen, deuterium, and helium targets bombarded by antiprotons.** Miyamura, Osamu (Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. (CONF-8103183—).

From Workshop on physics with 12 GeV PS at KEK; Oho, Ibaraki, Japan (9 Mar 1981).

The virtual photons produced by hydrogen, deuterium and helium targets and antiproton beam, and the exotic particles utilizing particle production which contradict with OZI law are considered. The process is considered with the string diagram. The production of virtual photons is caused by the pair annihilation of Q and anti Q at the edge of string. The mass of residual system can be derived by adjusting the momentum of the virtual photons even in the case below the threshold of nucleon-antinucleon collision. In case of deuterium and helium targets, the same argument can be applied. The use of the beam from 1 to 4 GeV/c is more favorable than the use of quasi-rest antiproton beam. If the logarithmic potential is good, the favorable point to be studied is the state of finite angular momentum just below the threshold. The production cross sections were evaluated. In the cross section of the annihilation of antiproton-deuterium and antiproton-helium collisions, new fine structures of about 10^{-27} and 10^{-28} cm^2 are expected.

19344 **(KMU-HEP—82-02) Double logarithmic asymptotics of quark scattering amplitudes with flavour exchange.** Kirschner , R.; Lipatov, L.N. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Feb 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700684.

We propose simple equations in terms of the definite signature partial waves of the quark scattering and annihilation amplitudes with quark-quark and quark-antiquark states in the exchange channel. We discuss the singularities in the complex angular momentum plane generated by the double logarithmic contributions and point out their relation to the particle Regge trajectories.

19345 **(KMU-HEP—83-01) Monte-Carlo code DECAY to simulate the decay of baryon and meson resonances.** Haenssgen, K.; Ritter, S. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jan 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700685.

The code DECAY simulates the decay of unpolarized baryon and meson resonances in the laboratory frame. DECAY treats some resonances among these all baryon resonances of the spin $3/2^+$ decuplet and all meson resonances of the spin 1^- nonet. A given resonance decays via two or three particle decay steps until all decay products are stable particles. Program summary and code description are given.

19346 **(KMU-HEP—83-02) Monte-Carlo code BAMJET to simulate the fragmentation of quark and diquark jets.** Ritter, S. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jan 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700686.

High energy (anti-) quark and (anti-) diquark jets produced in e^+e^--annihilation, lepton-nucleon collisions or hadron-hadron interactions are considered. The Monte-Carlo code BAMJET simulates the hadronization of single (anti-) quark and (anti-) diquark jets as well as the fragmentation of complete quark-antiquark, (anti-) quark - (anti-) diquark and diquark-antidiquark two jet events into hadrons on the basis of a phenomenological chain decay model.

19347 **(KMU-HEP—83-03) Monte-Carlo code PARJET to simulate e^+e^--annihilation events via QCD jets.** Ritter, S. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jan 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700687.

The Monte-Carlo code PARJET simulates exclusive hadronic final states produced in e^+e^--annihilation via a virtual photon by two steps: (i) the fragmentation of the original quark-antiquark pair into further partons using results of perturbative QCD in the leading logarithmic approximation (LLA), and (ii) the transition of these parton jets into hadrons on the basis of a chain decay model. Program summary and code description are given.

19348 **(LA-UR—84-644) Neutrino masses and mixings - an SPVAT analysis.** Goldman, T. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 16p. (CONF-840148—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007465.

From 3. international conference on baryon non-conservation; Park City, UT, USA (1 Jan 1984).

The connection between the form of the neutrino mass matrix and the problem of family symmetry is discussed. 16 references.

19349 **(SLAC-PUB—3242) Jets in e^+e^- annihilation.** Hollebeek, R. (Stanford Linear Accelerator Center, CA (USA)). Oct 1983. Contract AC03-76SF00515. 60p. (CONF-8307109—8). NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007919.

From 11. SLAC summer institute conference on particle physics - dynamics and spectroscopy at high energy; Stanford, CA, USA (18 Jul 1983).

We have a simple perturbative picture of the production of hadrons from e^+e^- annihilations which works quite well in predict-

ing the main features of this interaction. It explains the magnitude of the total cross-section, the basic two-jet structure, and the final state angular distributions. It is also consistent with our present ideas about the structure of hadronic matter and the requirement that at high enough energies, the corrections due to strong interactions are small and hence treatable in a perturbative sense. We have seen, however, that to progress beyond this point requires a detailed model of fragmentation phenomena and that differences in models prevent us from making clean predictions about QCD. It is therefore important that we continue to study the fragmentation process and try to parameterize it as well as possible. Large amounts of experimental data are now available on this subject, and new tests will become available as experimenters look in more detail at the behavior of quantum number correlations and energy dependent effects. In doing this, it will be important to keep in mind that mass effects can yield significant energy variations in the model parameters. Our eventual goal should be to find ways of treating the data which will yield quantitative tests of QCD. Studies of three- and four-jet fractions, three-jet fragmentation properties, and energy-energy correlations have begun, and hopefully with improved understanding of fragmentation effects, will yield such tests. 48 references.

19350 **Magnetic monopoles.** Carrigan, R.A. Jr. (Fermi National Accelerator Lab., Batavia, IL (USA)); Trower, W.P. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). *Nature (London);* **305**: No. 5936, 673-678(20 Oct 1983).

A solitary, uncorroborated event at Stanford is the only evidence that magnetic monopoles might exist. Powerful theoretical motivation for monopoles derives from Dirac's assertion that monopoles could explain charge quantization and the 't Hooft-Polyakov demonstration that monopoles are an inevitable consequence of many gauge theories presently being used to unify the electroweak (photon-lepton) and nuclear (quark) interactions. The monopole abundance suggested by the Stanford event is in clear contradiction to bounds on their number from astronomical data. Fortunately, the already considerable and expanding arsenal of detection techniques are being fashioned to experimentally test the many open questions surrounding monopoles.

19351 **Perturbative quantum chromodynamic analysis of deep inelastic scattering.** Herrod, R.T. Cambridge, England; Cambridge University (1982). 210p. British Library, Boston Spa, Wetherby, West Yorks. No. D43169/82.

This is an account of the field theoretic description of the deep inelastic scattering of leptons from nucleons. Starting from simple parton model description, using the assumption of an SU(3) colour confining field theory, for the quarks comprising hadronic matter, the well known prediction of Bjorken scaling is obtained. Field theoretic predictions for deviations from Bjorken scaling are formally introduced, with particular reference to quantum chromodynamics (QCD). This treatment is purely perturbative, although the renormalisation group is used to improve convergence. Scaling violations at both leading order, and next-to-leading order are discussed, and it is shown how these lead to predictions regarding the dependence of the moments of observable structure functions, on the square of the 4-momentum transferred (Q^2). Evolution equations for the moments of structure functions are then derived. The intuitive approach of Altarelli and Parisi (AP), which leads to predictions for the Q^2 dependence of the structure functions themselves, is introduced. The corresponding equations are derived to next-to-leading order. The results of an extensive analysis of current data are presented.. Both weak and electromagnetic structure functions are compared with the predictions of leading order, and higher order formulae. Methods for incorporating heavy quark flavours into the AP equations are discussed.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 19313, 19363, 19363, 19376

19352 **(BONN-HE—83-17) Stochastic structure of globally supersymmetric field theories.** Flume, R.; Lechtenfeld, O. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Sep 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750879.

We reformulate the bosonic sector of globally supersymmetric field theories through a "fermionisation" of bosonic Feynman graphs. The recipe for the fermionisation gives an explicit realisation of the Nicolai map. The graphical rules for supersymmetric Yang-Mills fields in the reformulated version turn out to be simpler than those of ordinary Yang-Mills fields.

19353 **(DESY—83-075) Dirac-Kaehler approach to the two dimensional Wess-Zumino N=2 model on the lattice.** Zimerman, A.H.; Aratyn, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750733.

We introduce a Dirac-Kaehler model for the two dimensional Wess-Zumino N=2 Lagrangean. We can show that in the model, when we go to the euclidean space-time lattive, we have no energy doubling, the action has no lattice surface terms (contrary to other authors), while the Hamiltonians (when time is continuous) present lattice surface terms.

19354 **(EFI—570(57)-82) Parity violation in electroexcitation of giant resonance and the structure of neutral weak current.** Christova, E.Kh.; Dadayan, N.A. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700680.

P-odd asymmetry is considered in the scattering of polarized electrons on even-even nuclei with excitation of various levels of giant resonance (1^-, T=1, S=0; 1^-, T=0.1; S=1; $2^- +$ T=0.1; S=1). It is shown that measuring of the discussed asymmetry on isovector and isoscalar levels of giant resonance allows to determine in a model independent way the structure of the parity violating e-N Lagrangian. Numerical estimates for the asymmetry summed up over all discussed levels are obtained in the framework of the Weinberg-Salam theory. For example, at the initial electrons energy E=200 MeV and the scattering angle THETA=150 deg the asymmetry is $A=-1.4\times10^{-5}$. The dependence of asymmetry on THETA at various E is presented. The asymmetry is shown to increase by absolute value with THETA and E.

19355 (INIS-mf—8156, pp 46-50) **Possible test of CP invariance in neutrino oscillations.** Bilenky, S.M.; Niedermayer, F. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1982. NTIS (US Sales Only), PC A19/MF A01. (CONF-820675—Vol.1).

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

A method is proposed for testing CP invariance in neutrino oscillations. The method is based on the comparison at some distance from source of fluxes of neutrinos and antineutrinos obtained from Ksub(L)-decays. Moreover, it is shown that in the case when properly normalized differences of neutrino and antineutrino fluxes are nonvanishing, their measurement would allow one to test CPT invariance and to get information on the number of neutrino types.

19356 (INIS-mf—8703, pp vp) **Finite-dimensional representations and Casimir operators of semi-simple graded Lie algebras.** Bednar, M.; Sachl, V. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19357 (INS-J—164, pp 2-8) **Sub-color and leptoquark-quark symmetry.** Nakamura, Fumihiko (Hiroshima Univ. (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

On the basis of leptoquark-quark symmetry, we propose possible models, in which leptons and gauge bosons are constructed is SU(2) symmetry. In one of the cases, the subcolor is introduced as the quantum number of the leptoquark. Then the possibility of baryon decay is discussed.

19358 (INS-J—164, pp 31-37) **Subcolor.** Takeshita, Seiichiro; Komatsu, Hiromasa; Inoue, Kenzo (Kyushu Univ., Fukuoka (Japan). Dept. of Physics); Kakuto, Akira. Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

Metacolor schemes and their supersymmetric versions are examined. In both cases it is found that schemes suitable for describing massless composite particles are ones based on the group E_6.

19359 (INS-J—164, pp 38-42) **Light fermions from dynamical gauge-symmetry breaking.** Minakata, Hisakazu (Tokyo Metropolitan Univ. (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

It is argued that the symmetric realization of the chiral symmetry can be achieved thanks to the breakdown of gauge symmetry. An illustrative scenario is described. Two-dimensional Abelian gauge theories are studied as soluble models of gauge-symmetry breaking and the results of this study are briefly summarized.

19360 (INS-J—164, pp 71-73) **Conserved spinor quantities.** Miyazawa, Hironari (Tokyo Univ. (Japan). Dept. of Physics). Mar 1982. NTIS (US Sales Only), PC A06/MF A01. (CONF-811281—).

From 4. INS winter seminar on structure of quarks and leptons; Tokyo, Japan (25 Dec 1981).

6454 Field Theory

REFER ALSO TO CITATION(S) 19306, 19309, 19352, 19353

19361 **(BONN-HE—83-16) Self-dual monopoles and calorons.** Nahm, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Sep 1983. 9p. (CONF-830959—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750892.

From 12. international colloquium on group theoretical methods in physics; Trieste, Italy (5 Sep 1983).

An elementary proof for the ADHM construction is given both for instantons and for self-dual monopoles and calorons. The description of calorons leads to the same nonlinear ordinary differential equation as in the case of monopoles, but with cyclic boundary conditions. Asymptotically, calorons look like monopoles. There one obtains a description in terms of a reduced gauge group. If extended over all space, one obtains singularities on algebraic curves given by the envelope of the spectral curve.

19362 (CERN—83-05, pp 103-144) **Fundamentals of QCD.** Taylor, J.C. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). 22 Jun 1983. NTIS (US Sales Only), PC A14/MF A01. (CONF-8209205—).

From CERN school of physics '82 meeting; Cambridge, UK (1 Sep 1982).

The author introduces quantum chromodynamics as a SU(3)-Yang-Mills theory describing the interactions between the quarks. After a general introduction the Feynman rules are discussed. Then the Ward identity is considered. Thereafter the renormalization is described. Finally the beta function and asymptotic freedom are considered.

19363 (CERN—83-05, pp 187-246) **Unification and grand unification.** Peccei, R.D. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). 22 Jun 1983. NTIS (US Sales Only), PC A14/MF A01. (CONF-8209205—).

From CERN school of physics '82 meeting; Cambridge, UK (1 Sep 1982).

I review the salient features of the standard model of electroweak and strong interactions and consider possible left-right symmetric extensions of this model. The motivations for further unification of the known forces are examined and an introduction is given to grand unified theories. The predictions of the minimal SU(5) model are critically analyzed and a brief discussion is given of some of the extant problems associated with grand unified theories.

19364 (CERN—83-05, pp 1-68) **Experimental tests of gauge theories.** Barbiellini, G. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati). 22 Jun 1983. NTIS (US Sales Only), PC A14/MF A01. (CONF-8209205—).

From CERN school of physics '82 meeting; Cambridge, UK (1 Sep 1982).

The author reviews the experimental tests of the Weinberg-Salam theory, quantum chromodynamics, and grand unified theories. These are studies of the V-A behaviour of weak charged currents, studies of weak neutral currents by measurement of parity violating asymmetries with special regards to deep inelastic scattering, neutrino-induced neutral-current interactions, charge asymmetry in deep inelastic muon scattering, and γ-Z interference in e^+e^--annihilation, which are related to the Weinberg-Salam theory, measurements of structure functions in deep inelastic scattering and jet studies in e^+e^--annihilation and inclusive hadronic processes which are related to quantum chromodynamics, and as tests of grand unified theories measurements of the proton decay.

19365 **(DESY—83-069) Unexpected behavior of an order parameter for lattice gauge theories with matter fields.** Meyer, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750254.

I consider a slightly modified definition of an order parameter that was recently suggested by DeTar and McLerran. It is supposed to test for confinement in lattice gauge theories when arbitrary matter fields are present, at finite physical temperature $\beta^{-1} > 0$. Its definition is quite directly related to confinement in the sense that no physical states with fractional baryon number can be observed. We test the parameter for different ranges of the coupling constants in the Z(2) Higgs model, whose phase structure is well known at zero temperature. It is found that the order parameter always shows the behavior characteristic of confinement, for all values of the coupling constants and arbitrary nonzero temperature.

19366 **(DESY—83-074) Estimate of the effect of virtual quark loops on meson masses in lattice QCD.** Montvay, I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750870.

The 0^- and 1^- meson masses are calculated in SU(2) lattice gauge theory at $\beta = 2.3$ with Wilson fermions on a 10^4 lattice. The calculation is based on a 32sup(nd) order hopping parameter expansion. The fermion determinant can be taken into account for quark masses heavier than proportional 600 MeV. For lighter quarks only an estimate is given due to the limitations of statistics.

19367 **(DESY—83-077) Composite model with five generations of massless leptons and quarks.** Xiaoyuan Li. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750887.

A new composite model of leptons and quarks is proposed. The preons in the antisymmetric 15-dim. representation of the hy-

percolor group SU(6)sub(HC) are simply assigned to the 4 and anti 4 representations of the Pati-Salam group SU(4)sub(c). The five generations of massless leptons and quarks with no exotics are obtained as the most simple solution to the 't Hooft anomaly-matching, decoupling and n-independence conditions for the unbroken subgroup SU(4)sub(L) x SU(4)sub(R) x U(1) x U(1) of the original entire global chiral symmetry SU(8)sub(L) x SU(8)sub(R) x U(1). The symmetry of the effective Lagrangian at the composite level can be identified as the partially grand unification group SU(4)sub(c) x SU(2)sub(L) x SU(2)sub(R). The color number 4 and the family number 5 are the natural results of the assignment of the preon hypercolor representation.

19368 **(DESY—83-082) Anomaly free condition and SU(3)sub(c) x U(1)sub(em) reality in grand unified theories.** Soh, K.S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750881.

If fermions are assigned to totally antisymmetric representation of SU(N), SU(3)sub(c) x U(1)sub(em) reality is a sufficient condition for vanishing anomaly. The anomaly free condition and the SU(3)sub(c) x U(1)sub(em) reality become equivalent if and only if Q = diag. ($^-$1/3, $^-$1/3, $^-$1/3, 1, 0, ..., 0).

19369 **(DESY—83-086) Classical models of confinement.** Lehmann, H.; Wu, T.T. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750903.

We investigate the structure of classical models of confinement by analytic methods. The models considered involve just one Abelian gauge field and can be viewed as non-linear versions of Maxwell's theory. We study in detail the case of two opposite static point charges. A scaling law is found for small separations of the charges, while a perturbation treatment is developed for large separations. The results obtained for large separations include an exact evaluation of the first correction term to the linear potential and a classification of the asymptotic field configurations.

19370 **(DESY—83-091) Continuum limit improved lattice action for pure Yang-Mills theory. Pt. 2.** Weisz, P.; Wohlert, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1983. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750904.

Wilson loops are calculated to one loop order using lattice actions including 6-link loops. The static potential is extracted and its small "a" expansion performed using coefficients determined at tree level. The Λ-parameter for Symanzik's improved action is thereby obtained and constraints placed on the coefficients appearing in the action at order g^2.

19371 **(DESY-L-Trans—280) Calculation of topological susceptibility in SU(3) lattice gauge theory.** Machaldiani, N.V.; Mueller-Preussker, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1983. 7p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750512.

The value of topological susceptibility in gauge theory with SU(3) symmetry group based on calculations by the Monte-Carlo method. The result is consistent with the formerly calculated value in the case of SU(2) group and is about two orders smaller than the value indispensable for the assumed solution of the Usub(A)(1) problem.

19372 **(DOE/ER/01545—344) Lifting scalar-quark and -lepton masses with sideways U(1)-II.** McCabe, J.F.; Wada, W.W. (Ohio State Univ., Columbus (USA). Dept. of Physics). 1984. Contract AC02-76ER01545. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84009060.

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We investigate the phenomenological consequences of an SUSY model with a gauged O'Raifeartaigh sector on scalar partner masses. The model has the gauge symmetry SU(5) x U(1). We find that this form of spontaneous SUSY breaking leads to large scalar partner masses through one loop graphs without changing quark and lepton masses from tree values, and without breaking SU(5) symmetries by the scalar partner sector. To calculate the scalar partner masses we extend previous work on supergraph techniques to include cases when SUSY is broken at tree level. We are able to sum exactly the corrections to unbroken propagators with the aid of a supersymmetric version of tree-level Dyson equations. We show how the same ideas can be implemented in an SU(5) gauge model where the normal Higgs give large masses radiatively to the scalar-quarks and -leptons. 7 references.

19373 **(EFI—569(56)-82) Fermion mass relations and the t-quark mass.** Asatryan, N.M. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700679.

Fermion mass relations are considered in grand unified models. In the assumption of linear coupling between the mass matrices of charged leptons and quarks with charges +2/3 and -1/3 a restriction is obtained on the t-quark mass m(t) <= 24.5 GeV.

19374 (INIS-mf—8703, pp vp) **Boson-fermion representations of Lie superalgebras osp(1,2) and osp(1,4).** Blank, J.; Exner, P.; Havlicek, M. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19375 **(INS—447) Light composite fermions in a dynamical subquark model of pregauge interactions.** Yasue, Masaki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1982. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700682.

The masses of composite leptons and quarks are discussed in a "dynamical subquark model of pregauge interactions". In this model, the leptons and quarks are made of a spinor subquark and a scalar subquark with an equal mass, M, and the gauge boson of the SU(3)sub(C) x SU(2)sub(L) x U(1)sub(Y) model are made of a subquark-antisubquark pair. A specific mechanism of generating an approximate global chiral symmetry of a composite lepton or quark is presented. The SU(2)sub(L) x U(1)sub(Y) symmetry is spontaneously broken due to the appearance of the composite Higgs scalar and the (scalar) subquark mass, M, is in turn bounded as M < 5.4 TeV ($=2\pi(6\sqrt{2}$ G sub(F)sup(-1))sup(1/2) where G sub(F) is the Fermi coupling constant). The spontaneously generated mass of a lepton or quark, m, is given by m -- αsub(em)($\sqrt{2}$ G sub(F)sup(-1))sup(1/2) where αsub(em) is the fine structure constant. The anomalous magnetic moments and "anomalous weak charged currents of the V + A form" of the leptons and quarks due to their substructure are estimated to be of order (αsub(em)/π) $(m/M)^2$. A lower bound on the subquark mass: M > 27.6 GeV (N sub(g) = 3), 30.6 GeV (N sub(g) = 4) is given by the experimental data of the deviation of the anomalous magnetic moment of the muon from the expected one in QEWD. The number, N sub(g), is the total number of the scalar subquarks and is assumed to represent the number of generations of the leptons and quarks. In this class of the dynamical model, the unification of the SU(2)sub(L) x U(1)sub(Y) theory and the SU(3)sub(C) theory takes place. The Weinberg angle, $\sin^2$theta sub(w), and the gluon coupling, αsub(c), are determined to be: $\sin^2$theta sub(w) = 3N sub(g)/[(4 + 3N sub(g))] and αsub(c) = (4 + 3N sub(g))αsub(em)/6, which coincide with those predicted in the unified SU(5) gauge theory if there exist four generations of the leptons and quarks (N sub(g) = 4).

19376 **(LBL—16846) Monopole catalysis: an overview.** Dawson, S. (Lawrence Berkeley Lab., CA (USA)). Nov 1983. Contract AC03-76SF00098. 10p. (CONF-8310227—7). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008236.

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

A summary of the talks presented in the topological workshop on monopole catalysis at this conference is given. We place special emphasis on the conservation laws which determine the allowed monopole-fermion interactions and on catalysis as a probe of the structure of a grand unified theory. 11 references.

19377 **(SLAC-PUB—3280) Nonlinear realizations and the partial breaking of extended supersymmetry.** Bagger, J.A. (Stanford Linear Accelerator Center, CA (USA)). Jan 1984. Contract AC03-76SF00515. 11p. (CONF-831267—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007803.

From Workshop on supersymmetry in physics; Los Alamos, NM, USA (15 Dec 1983).

In this paper we use nonlinear realizations to examine the breaking of N = 2 extended supersymmetry to N = 1. We derive Lagrangians and transformations laws for the generalized N = 2 Akulov-Volkov Goldstone field. We analyze the ghost states and show that they may be collected into N = 1 supermultiplets. We extend the transformation laws for the N = 1 chiral and vector multiplets to N = 2. Finally, we give the N = 2 generalization of an arbitrary N = 1 supersymmetric Lagrangian. 23 references.

19378 **Infrared problems in QCD and related topics.** Doria, R.M. Oxford, England; Oxford University (1981). 203p. British Library, Boston Spa, Wetherby, West Yorks. No. D45025/83.

This thesis is based in six works. The first is presented in the introduction in order to justify the philosophical part of the above title and to develop a concept of reality. In Chapter 1 the presence of Infrared Divergence in QCD is discovered. It is studied in the reaction q + q → γ^* + q + q + soft gluons, where q is the quark, γ^* is a virtual photon. The quarks are taken each to be colour (and spin) averaged. This gives a cancellation of the leading IR divergences. The uncancelled IR divergences change the Born cross section and dimensional IR regularisation with d = 4 + eta is used. The original work had errors which produced a cancellation in such a way that did not alter the final answer. At high energies this result is proportional to (1-β) ln (1-β). This means that at $\beta \rightarrow$ 1 this IR divergence effect is expected to disappear. In Chapter two, the same reaction is studied but with a gluon instead of a quark. Collinear divergence also appears. Chapter 3 is about the solution of one-loop integrals using hypergeometric functions. The solutions obtained are exact. Chapter 4 criticizes the way to predict the nature of the divergence through the Power Counting Method (NPC).

65 PHYSICS. II.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 19434

19379 **(UCID—18987-84) Report to the DOE Nuclear Data Committee, 1984.** Wong, C.; Haight, R.C.; Struble, G.L. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008023.

Experimental results are discussed for: ^{6} ^{7}Li(n,^{4}He) cross sections at 14 MeV, neutron elastic and inelastic scattering from carbon near 14 MeV, neutron capture cross sections for ^{46}Ca and ^{48}Ca at stellar temperatures, revised neutron cross sections for ^{142} ^{143} ^{144}Nd, fragment angular distribution for neutron fission of ^{232}Th, neutron differential scattering measurements in the actinide region, nuclear structure of ^{244}Am, conversion coefficients of the M4 transition in /sup 193m/Ir, gamma-ray and conversion-electron decay of the ^{228}U shape isomer, and levels of ^{244}Cm populated by the beta decay of 10-hr /sup 244g/Am and 26-minute /sup 244m/Am. Calculations described include tests of microscopic optical models for neutron and proton scattering on light nuclei in the range 14 to 45 MeV, a new dynamic model for fission, and the necessity of discrete-level modeling in isomer ratio calculations for neutron-induced reactions on deformed nuclei. Also, a reevaluation for ENDL of σ(n,f) and anti nu p for ^{235}U and ^{239}Pu from 100 keV to 20 MeV is described. 31 references. (WHK)

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 18954

19380 **(BONN-HE—83-15) Deuteron photodisintegration at photon energies between 200 and 700 MeV in backward direction.** Althoff, K.H.; Anton, G.; Bour, D.; Bock, B.; Ferber, W.; Gelhausen, H.W.; Horikawa, N.; Jahnen, T.; Kaul, O.; Koenig, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Sep 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750895.

The differential cross section of the deuteron photodisintegration was measured at a proton c.m. angle of 180 degrees and for photon energies between 180 and 730 MeV. The protons were detected in a magnetic spectrometer. The photon energy resolution varied between 30 MeV and 50 MeV FWHM. Since these are the first data at 180 degrees in this energy range a comparison can only be done with data from other laboratories extrapolated to 180 degrees and with theoretical predictions. The agreement with existing calculations is poor. Contributions of dibaryons to the cross section seem not to improve the situation.

19381 **(IFUSP-P—367) Non-adiabatic generator-coordinate calculation of H_2i.** Tostes, J.G.R.; Toledo Piza, A.F.R. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Oct 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700700.

A non-adiabatic calculation of the few lowest J=O states in the H_2^+ molecule done within the framework of the Generator Coordinate Method is reported. Substantial accuracy is achivied with the diagonalization of matrices of very modest dimensions. The resulting wavefunctions are strongly dominated by just a few basis states. The computational scheme is set up so as to take the best advantage of good analytical approximations to existing adiabatic molecular wavefunctions.

19382 **(JINR—E-4-82-189) Investigation of second-order optical potential for elastic π4He scattering.** Mach, R.; Sapozhnikov, M.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700706.

The calculations of elastic π^-^{4}He scattering within the framework of the optical model with a second-order potential were performed. The effects of recoil correlations, charge exchange and double spin (isospin) flip in the intermediate states are studied. The correction of the impulse approximation is investigated. Comparison between Kerman-McManus-Thaler and Watson formalisms is made.

19383 **(LA—9971-MS) Cross sections and Maxwellian reaction rates for polarized d + d reactions.** Hale, G.M.; Doolen, G.D. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008365.

Cross sections and Maxwellian reaction rates, averaged over incident relative directions, are given for the D Vector(d Vector,p)T and D Vector(d Vector,n)^{3}He reactions at low energies. These results are calculated from the current parameters of an extensive R-matrix analysis of reactions in the four-nucleon system. The analysis indicates that the averaged cross sections for deuterons interacting in spin-parallel polarized states are not strongly suppressed. The characteristic angular distributions could be used to obtain information about polarized deuterium plasmas.

19384 (INS-NUMA—29, pp 33-46) **Neutrons produced by the p + Be and the d + Be reactions, and the cross section measurement with these neutrons.** Sugiyama, Kazunori (Tohoku Univ., Sendai (Japan). Faculty of Engineering). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

Experiments on the neutron production with p + Be and d + Be reactions are reviewed, and an integral benchmark experiment for carbon at Tohoku University is introduced. The neutron production with thin Be targets has been studied in nuclear physics. At present, the neutron production with thick Be targets are investigated from the viewpoint of strong neutron sources for applied use. As monochromatic neutron sources, the p + T or the p + Li reactions are useful. With a thick Be target, a broad continuous neutron spectrum is obtained. The measurement of the total yield of neutrons is hard, and the development of the absolute measurement technique is desired. A bench experiment for carbon to study the measurement of neutron fluence was designed, and is in progress.

19385 (INS-NUMA—31, pp 49-52) **Preparatory study for physics of projectile fragments performed by the RCNP group. Neutron-rich isotope beam.** Kobayashi, Shinsaku (Kyoto Univ. (Japan). Faculty of Science). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

A feasibility study on neutron-rich isotope beam is reported. The projectile fragments produced by high energy heavy ion reactions are mostly neutron-rich nuclei. The energy of projectiles considered in this study is 250 MeV/amu. The momentum of the secondary beam is estimated to be 720 MeV/C with the error of 15.6 MeV/C. The estimated thickness of targets for this dispersion is 0.2 g/cm^2. The intensity of the secondary beam is 5.1 x 10^6/sec. The spread due to the Coulomb scattering is less than 1 mrad. By using this secondary beam, the production of superheavy nuclei may be possible. A spectrograph like the DUMAS constructed at RCNP will be useful for this study.

19386 (JAERI-M—9999, pp 257-267) **Assessment of secondary neutron data by the measurement of double differential emission cross sections.** Takahashi, Akito; Yamamoto, Junji (Osaka Univ., Suita (Japan). Faculty of Engineering). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8111184—; NEANDC(J)—81/U; INDC(JAP)—68/L).

From Seminar on nuclear data; Tokai, Ibaraki, Japan (26 Nov 1981).

Preliminary results of double differential neutron emission cross section measurement at OKTAVIAN facility to assess ENDF/B-IV and V data is presented. Comparison of experimental and calculated data is stressed for ^{12}C, and mentioned additionally for natural lithium.

19387 **(JINR—E-1-82-516) Possibile observation of dibaryon resonance in processes of relativistic deuteron fragmentation.** Ableev, V.G.; Dimitrov, Ch.; Filipkowski, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700079.

Results of measurements of the fragmentations of 8.9 GeV/c deuterons on C and CH_2 targets in the d+A → p+X reactions obtained at the Dubna synchrophasotron are presented and discussed. The hybrid model of deuteron wave function psisub(d)=psisub(np)+psisub(6q) is used for their description and its parameters are determined. A peak is observed in the momentum spectra of protons emitted at an angle of thetasub(p) <= 0.4 deg. It is interpreted as evidence for a dibaryon resonance with isospin I=0, M=(2.14+-0.01) GeV/c^2 and GITA=(80+-10) Mev/c^2.

19388 **(LA—9932-T) Experimental study of inclusive pion double charge exchange reactions in the delta resonance region.** Wood, S.A. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 252p. NTIS, PC A12/MF A01; 1; GPO Dep. Order Number DE84008368.

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An extensive experimental investigation of the inclusive pion double charge exchange (DCX) process has been carried out with pion energies in the region of Δ(1232) excitation. The reactions $^{16}O(\pi^+,\pi^-)X$ and $^{40}Ca(\pi^+,\pi^-)X$ were studied with pion beam kinetic energies of 120, 150, 180, 210, 240 and 270 MeV. With negative pions, the reactions $^{16}O(\pi^-,\pi^+)X$ and $^{40}Ca(\pi^-,\pi^+)X$ were observed with incident beam energies of 180, 210 and 240 MeV. In addition, some exploratory measurements were performed with carbon and lead targets with 180 MeV pions. At each energy, outgoing pion spectra were measured at three to five angles in the range 25° to 130°. These spectrometer-based measurements featured an almost complete coverage of the outgoing pion spectrum, from 15 MeV to the maximum energy for inclusive DCX (typically 30 MeV below the beam energy). This coverage allowed a reliable integration of the spectra so that angular distributions and total cross sections for inclusive DCX could be obtained. The spectra exhibit a large degree of similarity over the range of energies, targets, and scattering angles investigated. DCX is of interest because, by charge conservation alone, at least two nucleons in a nucleus must participate in the reaction. It is thus a natural way to study multiple scattering, which is potentially an important part of pion-nucleus reactions. The data are discussed qualitatively in the context of a double quasi-free scattering mechanism, by comparing the results with a simple two step Fermi Gas model. A simple cascade model of pion-nucleus reactions is also developed and compared with the DCX data. 60 references.

19389 **(LA—9960-T) Forward-angle pion inelastic scattering.** Bland, L.C. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 229p. NTIS, PC A11/MF A01; GPO Dep. Order Number DE84008367.

Thesis.

Forward-angle pion inelastic scattering was measured for ^{12}C, ^{28}Si, and ^{40}Ca to search for the predicted (but previously unobserved) spin-flip dipole state in these nuclei. Pion inelastic scattering angular distributions at T/sub pi/ = 164 MeV were also measured for the isoscalar, natural-parity states of ^{16}O and low-lying monopole states in ^{12}C and ^{28}Si to test the distorted-wave impulse approximation (DWIA) model of pion inelastic scattering. Existing structure information for these states enabled this quantitative test of the DWIA model. Generally, good agreement was found between these calculations and the data. Large discrepancies were observed, though, for the $^{16}O(1_1^-, 1_1^4, 0_3^+)$ states and the forward-angle cross sections for the $^{12}C(0_2^+)$ state. These discrepancies demonstrate the need for the contribution of higher-order processes to pion scattering. The forward-angle measurements on ^{12}C and ^{28}Si revealed the existence of forward-peaking angular distributions for states in the giant resonance region of these nuclei. Comparisons with DWIA calculations employing a transition density for a state exhausting the spin-flip dipole transition strength from the ground state indicate the present results have located a significant fraction of the expected strength. The present measurements are not sufficient to exclude the possibility that the observed forward-peaked enhancements are fragments of the giant monopole resonance. The observed strengths are inconsistent with extensive measurements performed with other probes if this were the correct interpretation. This indicates that a large fraction of the expected isoscalar, spin-flip dipole strength is concentrated in states which lie lower in excitation energy than the giant dipole resonance.

19390 **(LA—9970-T) Kinematically complete measurement of proton knockout by 220-MeV pions on ^{12}C.** Faucett, J.A. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE84008366.

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The nuclear reaction whereby an incident pion interacts with a nucleus, knocks out a single nucleon, and leaves the nucleus was studied. The experiment was performed with 220 MeV positive and negative pion beams incident on a natural carbon target. The final pion momentum and direction of travel were measured with a magnetic spectrometer. The ejected protons' momenta were measured with a scintillator array. Measurements were taken at scattered pion angles of 61°, 81°, 105°, and 127° for incident positive pions and at 81° for incident negative pions. The protons were observed at angles over the range from 15° to 90°. The final particles were observed both separately and in coincidence. The excitation of the residual nucleus was calculated for the coincidence events. Differential cross sections were obtained and displayed as pion and

proton energy spectra and as angular correlations. Ratios between the positive and negative pion data were made to elucidate the differences and common features of the two reactions. The data provides detailed evidence for the quasielastic picture of pion knockout reactions which is reflected in the similarity of the spectral peak energies to those seen in pion-nucleon elastic scattering. The importance of secondary processes such as pion multiple scattering and nucleon final state interactions becomes clearer with the separation of the data according to the residual nucleus excitation energy. The coincidence cross section is found to account for about half of the $(\pi^+,\pi^{+\prime})$ reaction and about half of this corresponds to quasifree knockout of the outer shell protons. For the $(\pi^-,\pi^{-\prime}p)$ reaction, the secondary processes are found to play a much more important role. The data will be valuable for future comparison with theoretical calculations.

19391 (ZfK—491, pp 54-57) **Influence of the target excitation on the scattering of polarized ^{6}Li from ^{58}Ni and ^{12}C.** Rusek, K. (Institute of Nuclear Research, Warsaw (Poland)). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

Spin-orbit potentials found in recent optical model analysis of the elastic scattering of polarized ^{6}Li ions on ^{58}Ni and ^{12}C nuclei at 20 MeV and 19.24 MeV, respectively, differ from those predicted by folding models. The differences may be accounted for collective structure of the used target. In order to investigate the influence of the target excitation on the elastic scattering we have carried out detailed coupled channels and DWBA calculations. For ^{12}C the existing inelastic scattering data were included in the analysis. The experimental data presented have been obtained in the Max Planck Institut fuer Kernphysik in Heidelberg using the source for polarized lithium ions at the Heidelberg EN-Tandem.

19392 **Folded diagrams and 1s-0d effective interactions derived from Reid and Paris nucleon-nucleon potentials.** Shurpin, J.; Kuo, T.T.S. (State Univ. of New York, Stony Brook (USA). Dept. of Physics); Strottman, D. (Los Alamos National Lab., NM (USA). Theoretical Div.). *Nuclear Physics [Section] A;* **408**: No. 2, 310-358(31 Oct 1983). With 56 refs.

The sd-shell effective-interaction matrix elements are derived from the Paris and Reid potentials using a microscopic folded-diagram effective-interaction theory. A comparison of these matrix elements is carried out by calculating spectra and energy centroids for nuclei of mass 18 to 24. The folded diagrams were included by both solving for the energy-dependent effective interaction self-consistently and by including the folded diagrams explicitly. In the latter case the folded diagrams were grouped either according to the number of folds or as prescribed by the Lee and Suzuki iteration technique; the Lee-Suzuki method was found to converge better and yield the more reliable results. Special attention was given to the proper treatment of one-body connected diagrams in the calculation of the two-body effective interaction. We first calculate the (engery-dependent) G-matrix appropriate for the sd-shell for both potentials using a momentum-space matrix-inversion method which treats the Pauli exclusion operator essentially exactly. This G-matrix interaction is then used to calculate the irreducible and nonfolded diagrams contained in the Q-box folded diagram series. We considered for approximations for the basic Q-box. These were (C1) the inclusion of diagrams up to 2nd order in G, (C2) 2nd order plus hole-hole phonons, (C3) 2nd order plus (bare TDA) particle-hole phonons, and (C4) 2nd order plus both hole-hole and particle-hole phonons. Comparisons between calculated spectra and experiment were done for ^{18}O, ^{18}F, ^{19}F, ^{20}O, ^{20}Ne, ^{22}Ne, ^{22}Na and ^{24}Mg.

19393 **Refractive effects in ^{9}Be scattering and nuclear rainbow ghosts.** Satchler, G.R.; Fulmer, C.B.; Auble, R.L.; Ball, J.B.; Bertrand, F.E.; Erb, K.A.; Gross, E.E.; Hensley, D.C. (Oak Ridge National Lab., TN (USA)). *Physics Letters, [Section] B;* **128**: No. 3/4, 147-152(25 Aug 1983).

Data for the elastic scattering of ^{9}Be on ^{12}C and ^{16}O at 158 MeV provide evidence of refractive effects that allow the optical potentials to be determined with little ambiguity. The real potentials are deep. Large angle data indicate dominance of negative-angle scattering from the far side of the target nucleus. The analysis also implies a residual rainbow phenomenon, contrary to what has been seen previously in heavy-ion scattering. We suggest this be called a rainbow ghost.

19394 **(IAE—3571/2) High energy nuclei collisions in the hydrodynamic model with account of freezing effects.** Mishustin, I.N.; Satarov, L.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 44p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700699.

Heavy ions collisions in E approximately 0.1-1 GeV/nucl. energy range of the incident nuclei are examined. It is proposed that thermodynamical equilibrium area of the compressed nuclear matter, which expansion is described within the limits of relativistic hydrodynamics, is formed in the initial stage of the reaction. The equation of state of nucleons, π-mesons and Δ-resonances equilibrium gas is discussed. It is considered that the stage of free scattering of particles begins at the moment when the pair collision frequency becomes less than the rate of decrease of the matter local density. Calculated results of the inclusive cross sections of proton and π-meson yield in the ^{20}Ne+^{20}Ne, ^{40}Ar+^{40}Ar, ^{238}U+^{238}U reactions at E=0.4; 0.8 and 2.1 GeV/nucl. are presented. The comparison with the experimental data is carried out.

19395 **(IFUSP-P—374) Validity of the classical description of nuclear scattering.** Hussein, M.S.; Chen, Y.T.; Almeida, F.I.A. de. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1982. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700696.

The description of nuclear scattering using classical trajectory concepts is discussed. Analysis of the condition of validity of this description within the N. Bohr uncertainly arguments, is made. Applications to the scattering systems, p sub(+) ^{28}Si and ^{16}O sub(+) ^{28}Si a ECM = 8.0 MeV and 55.6 MeV, respectively are made.

19396 **(INDC(GDR)—20) Description of the evaluated neutron nuclear data file 2015 for Silicon of the SOKRATOR library.** Hermsdorf, D. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1982. 67p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700713.

This paper describes the contents of file 2015 for Silicon of the Soviet library of evaluated neutron nuclear data SOKRATOR and the methods used for evaluation. Especially the experimental and calculated results chosen for nuclear data recommendations will be discussed. The numerical figures obtained have been formatted in ENDF/B-V format.

19397 **(INDC(GDR)—22) Consistent interpretation of neutron-induced charged-particle emission in silicon.** Hermsdorf, D. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jun 1982. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700714.

Users requesting gas production cross sections for Silicon will be confronted with serious discrepancies taking evaluated data as well as experimental ones. To clarify the accuracies achieved at present in experiments and evaluations in this paper an intercomparison of different evaluated nuclear data files has been carried out resulting in recommendations for improvements of these files. The analysis of the experimental data base also shows contradictory measurements or in most cases a lack of data. So an interpretation of reliable measured data in terms of nuclear reaction theories has been done using statistical and direct reaction mechanism models. This study results in a consistent and comprehensive evaluated data set for neutron-induced charged-particle production in Silicon which will be incorporated in file 2015 of the SOKRATOR library.

19398 **(JAERI-M—83-019) Data on thick target bremsstrahlung produced by electrons.** Tanaka, Susumu; Tanaka, Ryuichi; Nakai, Yohta; Ozawa, Kunio; Tabata, Tatsuo; Ito, Rinsuke. (Japan Atomic Energy Research Inst., Tokyo). Feb 1983. 109p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700697.

A systematic set of calculated data on the bremsstrahlung produced by electrons normally incident on thick targets is presented. The data have been generated by the Monte Carlo code developed by Berger and Seltzer. The incident energies of electrons considered are 1, 3, 10, and 30 MeV; the target materials considered are C, Al, Fe, Cu, Mo, and W. Differential bremsstrahlung intensity spectra for various angles of emission are graphically shown, and numerical data on bremsstrahlung spectra and angular distributions are given in tables.

19399 (ZfK—491, pp 204-205) **Collective excitation in neutron scattering on ^{28}Si for energies 6.8 to 14.8 MeV.** Streil, T.; Schmidt, D.; Seeliger, D. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

The direct excitation is known to give an essential contribution to the reaction mechanism in neutron scattering on lowlying collective states in the target nucleus. The aim of the present work is the theoretical analysis of the experimental data, obtained under the same conditions with a consistent set of parameters in a wide energy range and including higher excited states to get more information about reaction mechanism and also the nuclear structure.

19400 **DWIA predictions of (p,p') data using electromagnetically constrained densities.** Miskimen, R.A.; Bernstein, A.M.; Quinn, B.; Wood, S.A. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics; Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science); Hynes, M.V. (Los Alamos National Lab., NM (USA)); Blanpied, G.S.; Ritchie, B.G. (South Carolina Univ., Columbia (USA)); Brown, V.R. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Physics Letters, [Section] B;* **131**: No. 1-3, 26-30(10 Nov 1983).

DWIA predictions and comparison with experiment are made for 650 and 800 MeV proton scattering to low lying states in ^{24}mg, ^{26}Mg, ^{28}Si, ^{30}Si, ^{34}S, ^{40}Ca and ^{42}Ca. Electromagnetic constraints on proton and neutron ground-state and transition densities are used to minimize nuclear structure uncertainties Generally good agreement with the data is seen.

19401 **(IFUSP-P—381) ^{12}C(d,n)^{13}N reaction between E sub(d) = 7.0 and 13.0 MeV.** Schelin, H.R.; Pessoa, E.F.; Wylie, W.R.; Cybulska, E.W.; Nakayama, K.; Fagundes, L.M.F.; Douglas, R.A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Dec 1982. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700710.

Absolute differential cross sections for the n0, n1 and (n2 + n3) neutron groups from the reaction ^{12}C(d,n)^{13}N have been measured at incident deuteron energies of 7.0, 9.1 and 13.0 MeV along with an excitation curve at theta lab = 25° from E sub(d) = 10.6 to 13.0 MeV. Analysis of energy averaged cross sections included distorted wave Born approximation (DWBA) calculations and Hauser Feshbach reduction factors are obtained and compared to previously exported values.

19402 **(INDC(AUS)—9/L) Evaluation of the ^{58}Ni(n,2n)^{57}Ni cross sections.** Pavlik, A.; Winkler, G. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jun 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700711.

The excitation function for the reaction ^{58}Ni(n,2n)^{57}Ni was evaluated in the neutron-energy range from the threshold (12.41 MeV) to 20 MeV. All available experimental data sets were critically reviewed and obviously erroneous data sets were disregarded. If necessary, the data were renormalized in order to take into account adjustments of the decay data of the product nucleus ^{57}Ni and of reference cross sections. Cross section values were evaluated for energy groups 0.2 MeV to 1.5 MeV wide, the width depending on the number of available data points. For each evaluated cross section value also an uncertainty, representing an equivalent standard deviation, was derived taking into account the errors given by the experimentalists (after a critical review) and the general consistency of the experimental data. In addition the covariance matrix and the correlation matrix of the evaluated cross section data were derived. In the energy range above 15 MeV the results of the evaluation are up to 30% higher than the values from the ENDF/B-V, caused by the inclusion of a number of recent experiments and by renormalizations applied according to adjustments in the decay scheme of ^{57}Ni.

19403 **(KFK—3516) Neutron capture in s-wave resonances of ^{56}Fe, ^{58}Ni, and ^{60}Ni.** Wisshak, F.; Kaeppeler, F.; Reffo, G.; Fabbri, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik). Jul 1983. 66p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750255.

The neutron capture widths of s-wave resonances in ^{56}Fe (27.7 keV), ^{58}Ni(15.4 keV) and ^{60}Ni (12.5 keV) have been determined using a setup completely different from previous experiments. A pulsed 3-MV Van de Graaff accelerator and a kinematically collimated neutron beam, produced via the ^{7}Li (p,n) reaction, was used in the experiments. Capture gamma-rays were observed by three Moxon-Rae detectors with graphite-, bismuth-graphite-, and bismuth-converters, respectively. The samples were positioned at a neutron flight path of only 8 cm. Thus events due to capture of resonance scattered neutrons in the detectors or in surrounding materials are completely discriminated by their additional time of flight. The high neutron flux at the sample position allowed the use of very thin samples (0.15 mm-0.45 mm), avoiding large multiple scattering corrections. The data obtained with the individual detectors were corrected for the efficiency of the respective converter materials. For that purpose, detailed theoretical calculations of the capture gamma-ray spectra of the measured isotopes and of gold, which was used as a standard, were performed. The final results are: GAMMAsub(γ)(27.7 keV, ^{56}Fe) = 1.06 +- 0.05 eV, GAMMAsub(γ)(15.4 keV, ^{58}Ni) = 1.53 +- 0.10 eV and GAMMAsub(γ)(12.5 keV, ^{60}Ni) = 2.92 +- 0.19 eV. The accuracy obtained with the present experimental method represents an improvement of a factor 3-6 compared to previous experiments. The investigated s-wave resonances contribute 10-40% to the total capture rate of the respective isotopes in a typical fast reactor.

19404 **(LA—9947-T) Core excitation effects in pion double charge exchange.** Kaletka, M.O. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 142p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84007990.

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We have measured 5° cross sections for the pion double charge exchange reactions ^{42}Ca(π^+,π^-)^{42}Ti, ^{48}Ca(π^+,π^-)^{48}Ti, and ^{48}Ti(π^+,π^-)^{48}Cr at incident pion energies of 130, 180, 235, and 292 MeV, using the EPICS pion spectrometer facility of the Los Alamos Meson Physics Facility. Excitation functions are presented for the ΔT=0 double-isobaric analog transitions to ^{42}Ti(G.S.), ^{48}Ti(17.379 MeV), and ^{48}Cr(8.75 MeV), as well as for the ΔT=-2 non-analog transitions to ^{48}Ti(G.S.) and ^{48}Cr(G.S.). The shapes of the excitation functions for analog and non-analog transitions are found to be similar to previous measurements on light nuclei. We compare the measured forward-angle cross sections for analog transitions to simple diffractive model calculations which predict a dependence for double charge exchange cross sections proportional to (N-Z)(N-Z-1)/(A/sup 10/3/). While the ^{48}Ca and ^{48}Ti cross sections are found to agree well with this proportionality at both 180 and 292 MeV, in both cases the ^{42}Ca cross sections are found to be anomalously high when compared with other existing data. We attempt to interpret the data using theoretical models in which second-order terms are introduced in the optical model potential. It is found that the data can not be understood in the framework of theories which do not include detailed nuclear structure. However, using a model in which both the second-order optical potential and nuclear structure details are included results in a separation of nu-

clear structure and reaction mechanism effects. Core excitation components are found to be particularly important in understanding the details of the ^{43}Ca excitation functions. Extensive list of references.

19405 **(MPI-PAE/Exp.El.—123) Projectile collision inside the nucleus.** De Marzo, C.; De Palma, M.; Distante, A.; Favuzzi, C.; Lavopa, P.; Maggi, G.; Posa, F.; Ranieri, A.; Selvaggi, G.; Spinelli, P. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Nov 1983. 24p. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.).

Interactions of 200 GeV/c protons on hydrogen, neon, argon and xenon were studied with a streamer chamber spectrometer. The number of projectile collisions inside the nucleus and the number of secondary collisions in the intranuclear cascade were estimated. The dependence of multiplicity and rapidity distributions on the number of projectile collisions was analysed. The predictions of the Additive Quark Model were found to be in qualitative agreement with the results of the experiment.

19406 **(WIS-PH—82/40) Nuclear polarization and sign of the quadrupole moment of the ^{54}Fe(10$^+$) isomer.** Dafni, E.; Hass, M.; Bertschat, H.H.; Broude, C.; Davidovsky, G.; Goldring, G.; Lesser, P.M.S. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Aug 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700081.

A novel approach to the determination of signs of quadrupole deformations of high-spin isomers is presented. Recoiling ^{54}Fe(10$^+$) isomers, populated by the ^{45}Sc(^{12}C,p2n) reaction are polarized by passage through an array of tilted carbon foils and stop in a Cd single crystal. The observation of a quadrupole precession serves to measure both the induced nuclear polarization and the sign of the quadrupole moment. A positive sign of Q[^{54}Fe(10$^+$)] has been deduced.

6516 Nuclear Properties And Reactions, A=59-89, Theoretical

19407 **(KFK—3582) Neutron capture in s-wave resonances of ^{64}Ni.** Macklin, R.L.; Reffo, G.; Fabbri, F.; Wisshak, K.; Kaeppeler, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Sep 1983. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750740.

The neutron capture widths of the s-wave resonances at 13.9 and 33.8 keV in ^{64}Ni have been determined using a setup with extremely low neutron sensitivity completely different from all previous experiments on this isotope. This feature is important because these resonances exhibit a very large scattering to capture ratio. A pulsed 3-MV Van de Graaff accelerator and a kinematically collimated neutron beam, produced via the ^{7}Li (p, n) reaction, was used in the experiments. Capture gamma-rays were observed by three Moxon-Rae detectors with graphite-, bismuth-graphite-, and bismuth-converter, respectively. The samples were positioned at a neutron flight path of only 6-8 cm. Thus events due to capture of resonance scattered neutrons in the detectors or in surrounding materials are completely discriminated by their additional time of flight. The short flight path and the high neutron flux at the sample position allowed for a signal to background ratio of approx.= 1 even for the broad resonance at 33.8 keV. The data obtained with the individual detectors were corrected for the efficiency of the different converter materials. For that purpose, detailed theoretical calculations of the capture gamma-ray spectra of the measured isotope and of gold, which was used as a standard, were performed. The final radiative widths are GAMMAsub(γ)(13.9 keV) = 1.01 +- 0.07 eV and GAMMAsub(γ) (33.8 keV) = 1.16 +- 0.08 eV, considerably smaller than the rough estimates obtained in previous work.

19408 **(ZfK—497) Determination of nuclear pico-second lifetimes by means of the Doppler effect.** Winter, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Mar 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700082.

The analysis of pico-second lifetime measurements for nuclear states on the basis of the Doppler effect is described whereby experiments with thick targets (Doppler shift attenuation method) and thin targets in the plunger arrangement are considered. The lifetime is deduced from the lineshape of γ-ray peaks measured in single spectra in connection with neutron evaporation reactions. The stopping of the recoiling nuclei is calculated by means of the Monte-Carlo method. This method is also applied to average over the various kinematical variables. Illustrative examples for lifetime measurements using the DSA method for levels in ^{76}Kr and the plunger method for levels in ^{82}Kr are presented.

19409 **(CONF-840202—21) Conversational eigenanalysis program for solving differential equations.** Killough, G.G.; Eckerman, K.F. (Oak Ridge National Lab., TN (USA)). 1984. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007560.

From 17. midyear topical meeting of the Health Physics Society; Pasco, WA, USA (5 Feb 1984).

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Dynamic models that arise in health physics applications are often expressed in terms of systems of ordinary differential equations. In many cases, such as box models that describe material exchange among reservoirs, the differential equations are linear with constant coefficients, and the analysis can be reduced to the examination of solutions of initial-value problems for such systems. This paper describes a conversational code, DIFSOL, that permits the user to specify the coefficient matrix and an initial vector of the system; DIFSOL prints out closed-form solutions [i.e., expressed as linear combinations of terms of the form e/sup -at/, e/sup -at/cos bt, and e/sup -at/sin bt] and tables of the solution, its derivative, and its integral for any specified linear combination of state variables. The program logic permits menu-driven control. We have operated a FORTRAN IV version of the code on a DEC PDP-10 for several years. A translation into BASIC has proved practical on Radio Shack TRS-80 Model I and III personal computers for smaller systems of differential equations (< 12 state variables). The paper includes illustrations of the use of DIFSOL in studying metabolic models.

19410 **(INDC(CCP)—200/L) Fission barriers and GAMMAsub(n)/GAMMAsub(f) systematics for heavy nuclei (92<=Z<=100).** Kupriyanov, V.M.; Smirenkin, G.N.; Fursov, B.I. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700702.

This document evaluates and summarizes data on fission barriers and the energy dependence on the neutron/fission widths for nuclei between Z=92 and Z=100.

19411 **(INDC(NDS)—143/GP(no.9)) Progress in fission product nuclear data. Information about activities in the field of measurements and compilation/evaluations of fission product nuclear data (FPND).** Lammer, M. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Aug 1983. 172p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE84700715.

This is the ninth issue of a report series on Fission Product Nuclear Data (FPND) which is published by the Nuclear Data Section (NDS) of the International Atomic Energy Agency (IAEA). The purpose of this series is to inform scientists working on FPND, or using such data, about all activities in this field which are planned, ongoing, or have recently been completed. The main part of this report consists of unaltered original contributions which the authors have sent to IAEA/NDS. The present issue contains also a section with some recent references relative to fission product nuclear data, which were not covered by the contributions submitted. The types of activities being included in this report are

measurements, compilations and evaluations of: Fission product yields (neutron induced and spontaneous fission); Neutron reaction cross sections of fission products; Data related to the radioactive decay of fission products; Delayed neutron data of fission products; and lumped fission product data (decay heat, absorption etc.). The eighth issue of this series has been published in July 1982 as INDC(NDS)-130. The present issue includes contributions which were received by NDS between 1 August 1982 and 25 June 1983.

19412 (JAERI-M—9999, pp 110-124) **Estimation of delayed-neutron emission probabilities.** Nakasima, Ryuzo (Hosei Univ., Tokyo (Japan)). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8111184—; NEANDC(J)—81/U; INDC(JAP)—68/L).

From Seminar on nuclear data; Tokai, Ibaraki, Japan (26 Nov 1981).

According to the recent experimental progress, it is necessary to reevaluate the delayed-neutron data included in the first version of JNDC FP Decay Data File. This review is concerned with several methods used in estimating the delayed-neutron emission probabilities for possible delayed-neutron precursors.

19413 **Widths of isovector monopole resonances.** Adachi, S. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study; Los Alamos National Lab., NM (USA)); Auerbach, N. (Los Alamos National Lab., NM (USA)). *Physics Letters,* [*Section*] *B;* **131**: No. 1-3, 11-15(10 Nov 1983).

The widths of the isovector monopole ΔTsub(z)=1 component in ^{208}Tl, ^{140}La, ^{120}In and ^{90}Y are evaluated within the self-consistent Hartree-Fock+charge-exchange RPA using the Skyrme interaction. The coupling of 1p-1h states to 2p-2h configurations is microscopically calculated. The results are compared with those of recent pion charge-exchange reactions.

19414 **Delayed-neutron energy spectra of ^{93}-^{97}Rb.** Greenwood, R.C.; Caffrey, A.J. (EG & G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **45**: 705-707(Oct 1983). (CONF-831047—).

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

19415 **Rotational motion at finite temperature.** Kunz, J. (Los Alamos National Lab., NM (USA). Theoretical Div.); Mosel, U. (Giessen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). *Nuclear Physics* [*Section*] *A;* **406**: No. 2, 269-284(19 Sep 1983).

With 37 refs.

Moments of inertia and rotational velocity fields are calculated in the cranking model for the harmonic oscillator and the Nilsson potential for even-even rare earth nuclei. By means of a temperature-averaging procedure these quantities are decomposed into a smooth and a shell-structure-dominated part. The results are in good agreement with the corresponding Strutinsky-averaged results. The velocity fields are analyzed in terms of vector spherical harmonics and compared to rigid flow. The smooth velocity fields reveal rigid flow in the nuclear interior; in the surface region a deviation from rigid flow occurs, giving rise to a backflow in the inner system. The temperature dependence of the smooth moments of inertia is approximated by a quadratic function.

19416 **(GSI—83-7) Magnetic moments of high spin rotational states in ^{158}Dy and ^{164}Dy^{+}.** Seiler-Clark, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Heidelberg Univ. (Germany, F.R.)). Sep 1983. 187p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84750736.

For the study of their magnetic moments yrast states in ^{158}Dy and ^{164}Dy were excited via the multiple-Coulomb excitation by a 4.7 MeV/u ^{208}Pb beam. Hereby especially the question was of interest, how the one-particle effects in the nuclear structure in the region of the backbending anomaly in ^{158}Dy take effects on the g-factors of the high spin states in this region. The particle-γ angular correlations perturbed in the transient magnetic field during the passing of the excited Dy ions through a thin magnetized iron foil were measured. By the selective position-sensitive detection of Dy recoil ions and Pb projectiles under forward angles it was possible to determine additionally to the g-factors in the backbending region also g-factors in the spin region I <= 8 in ^{158}Dy and ^{164}Dy by detection of the particle-γ correlations precessing in the static hyperfine field after implantation in iron. The static hyperfine field was at the 4^{+} state in ^{164}Dy determined to B (Dy,Fe) = 245+-25 T. The g-factors were determined by comparison of the experimental results with calculations of the perturbed angular correlations by time-differential regarding of the population and de-excitation of the yrast states as well as by precession and hyperfine-relaxation effects during the flight of the Dy ions in the vacuum.

19417 (INIS-SU—198, pp vp) **Autoionization of recoil atom from a heavy ion reaction.** Majdikov, V.Z.; Surovitskaya, N.T. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19418 **(LYCEN—8220) Hyperfine interactions measured by nuclear orientation technique.** Brenier, R. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). 1982. 54p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700080.

This report concerns the use of hyperfine interaction to magnetism measurements and to the determination of the nuclear structure of Terbium isotopes by the low temperature nuclear orientation technique. In the first part we show that the rhodium atom does not support any localized moment in the chromium matrix. The hyperfine magnetic field at the rhodium nuclear site follows the Overhauser distribution, and the external applied magnetic field supports a negative Knight shift of 16%. In the second part we consider the structure of neutron deficient Terbium isotopes. We introduce a coherent way of evaluation and elaborate a new nuclear thermometer. The magnetic moments allow to strike on the studied states configuration. The analysis of our results shows a decrease of the nuclear deformation for the lighter isotopes.

19419 **Test of vibrational current distributions in transverse electron scattering.** Wuest, E.; Mosel, U. (Giessen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik); Kunz, J. (Los Alamos National Lab., NM (USA). Theoretical Div.); Schuh, A. (Washington Univ., Seattle (USA). Inst. for Nuclear Theory; Washington Univ., Seattle (USA). Dept. of Physics). *Nuclear Physics* [*Section*] *A;* **406**: No. 2, 285-290(19 Sep 1983).

The transition current distribution for the low-lying 2^{+} state at 4.085 MeV in ^{208}Pb obtained in a realistic cranked shell-model calculation is used to calculate the transverse PWBA form factor for inelastic electron scattering to this state. By keeping the same density but changing the velocity field to that of irrotational, incompressible flow the sensitivity of the form factor to the dynamics of nuclear vibrational motion is explored. It is found that the two flow patterns lead to significant observable differences in the form factors.

19420 **Microscopic calculation of dynamical effects. The energy dependence of nucleon self-energies in ^{208}Pb.** Sommermann, H.M. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Ratcliff, K.F. (State Univ. of New York, Albany (USA). Dept. of Physics); Kuo, T.T.S. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). *Nuclear Physics* [*Section*] *A;* **406**: No. 1, 109-133(12 Sep 1983). Contract AC02-76ER13001.

With 31 refs.

Dynamical effects on the single-particle self-energy Σ(ω) i.e. its ω-dependence, are studied microscopically using realistic finite-range NN interactions (Reid soft-core reaction matrix). The self-energy Σ(ω) and corresponding effective mass msup(*) (ω) are evaluated for proton and neutron particles in ^{209}Bi and ^{209}Pb (first and second shell) and for proton and neutron holes in ^{207}Tl and ^{207}Pb. We calculate, furthermore, the self-consistent energies and related spectroscopic factors (Z). In heavy nuclei the coupling of particles to highly collective low-lying surface vibrations is found to cause dynamical effects much stronger than in nuclear matter. Consequently, the single-particle and single-hole energies which enter

into the calculation of highly excited states are different from their experimental values. The correct inclusion of dynamical effects in the calculation of the giant dipole resonance is discussed.

19421 **(IAEA-R—2060-F) Research within the coordinated programme on intercomparison of evaluation of actinide neutron nuclear data. Final report for the period 1 December 1977 - 14 December 1982.** Yiftah, S. (International Atomic Energy Agency, Vienna (Austria)). Mar 1983. 35p. (IA—1383). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700708.

An evaluation of ^{248}Cm neutron data was performed. All significant cross sections in the neutron energy range 10^{-3} to $15x10^{6}$eV were considered. The experimental data were complemented by spherical optical model and statistical theory calculations. The evaluated data were compared with those in the ENDF/B-V file.

19422 **(IAEA-R—2061-F) Evaluation of some neutron nuclear data for 232-Th, 233-U, and 231,232,233-Ra. Part of a coordinated programme on intercomparison of actinide neutron nuclear data. Final report for the period 1 October 1977 - 30 September 1983.** Vasiliu, G. (International Atomic Energy Agency, Vienna (Austria)). Mar 1983. 17p. (IAEA-NDS—12/6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700709.

Neutron nuclear data were evaluated for Th-232 and Pa-233, including neutron cross-sections (total, elastic scattering, inelastic scattering, radiative capture, fission, (n,2n), (n,3n)), angular and energy distributions of secondary neutrons, average number of neutrons emitted per fission, and decay data, for the energy range of incident neutrons from 0 to 20 MeV. The evaluation is based on experimental data and on theoretical nuclear models. Further details are given in the IAEA reports: INDC(ROM)-10 for Th-232, INDC(ROM)-12 for Pa-233. The numerical data in ENDF/B format were included in the IAEA Nuclear Data Library: INDL-9090 for Th-232, INDL-9193 for Pa-233. Reports and data files are available from the IAEA Nuclear Data Section.

19423 **(INDC(CCP)—196/GE) Half-lives of long-lived isotopes of transactinium elements from ^{228}Th to ^{257}Fm.** Surin, V.M.; Fomushkin, Eh.F. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Sep 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700712.

The experimental measurements and critical evaluation results of the long-lived isotope half-decay periods of transactinium elements (from ^{228}Th to ^{257}Fm) are given on July 1981 to be published in open literature and related to the natural radioactive decay. From the massif of the known half-decay periods the most reliable data were selected, received or evaluated and recommended for practical use; the calculations of isotope specific activities were performed on this data.

19424 **(INDC(NDS)—130/GandP(No.8)) Progress in fission product nuclear data. Information about activities in the field of measurements and compilation/evaluations of fission product nuclear data (FPND).** Lammer, M. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Jul 1982. 213p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE83704522.

This is the eighth issue of a report series on Fission Product Nuclear Data (FPND) which is published by the Nuclear Data Section (NDS) of the International Atomic Energy Agency (IAEA). The purpose of this series is to inform scientists working on FPND, or using such data, about all activities in this field which are planned, ongoing, or have recently been completed. The main part of this report consists of unaltered original contributions which the authors have sent to IAEA/NDS. Therefore, the IAEA cannot be held responsible for the information contained nor for any consequences resulting from the use of this information. The present issue contains also a section with some recent references relative to fission product nuclear data, which were not covered by the contributions submitted. The types of activities being included in this report are measurements, compilations and evaluations of: Fission product yields (neutron induced and spontaneous fission); Neutron reaction cross sections of fission products; Data related to the radioactive decay of fission products; Delayed neutron data of fission products; and lumped fission product data (decay heat, absorption etc.). The seventh issue of this series has been published in July 1981 as INDC(NDS)-116. The present issue includes contributions which were received by NDS between 1 August 1981 and 15 June 1982.

19425 **(PB—84-135912) Measurement of the (235)U(n,f) cross section from 0.3 to 3.0 MeV using the NBS (National Bureau of Standards) electron linac. Final report.** Carlson, A.D.; Behrens, J.W. (National Bureau of Standards, Washington, DC (USA)). 1983. 4p. Pub. in Proceedings of International Conference on Nuclear Data Science Technology Held at Antwerp (Belgium) on September 6-10, 1982, p456-459 1983.

Progress is reported on a measurement of the 235U(n,f) cross section from 0.3 to 3.0 MeV using the NBS electron linac as a pulsed neutron source. Fission events were detected using a parallel-plate, ionization fission chamber located 69.5 m from the neutron-producing tungsten target and containing 170.9 plus or minus 2.1 mg of (235)U. The absolute neutron flux was measured with the NBS black neutron detector, located at 200.4 m and coaxial with the fission chamber. A Monte Carlo program was used to calculate the neutron detection efficiency of the black detector. The present paper gives preliminary results.

6530 Nuclear Theory

19426 **(CTA-EAV-NT—013/82) Interactions among resonances in the unresolved region.** Queiroz Bogado Leite, S. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Atividades Espaciais). Nov 1982. 22p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700698.

The theory on resonance absorption in the unresolved region is reviewed and a subroutine is presented, optional to UNRES in MC^2 code. Comparisons with the isolated resonance model suggest the necessity, in some cases, of considering interference and overlapping effects among resonances of the system.

19427 **(FERMILAB-Conf—83/107-THY) MONOPON-UCLEOSIS: the wonderful things that monopoles can do to nuclei if they are there.** Lipkin, H.J.;. (Weizmann Inst. of Science, Rehovoth (Israel); Argonne National Lab., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1983. Contract AC02-76CH03000;W-31-109-ENG-38. 9p. (CONF-8310227—5). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007955.

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

Portions are illegible in microfiche products.

In this talk we consider the wonderful things that monopoles can do to nuclei by examining nuclear physics in strong magnetic fields. We have seen that monopoles can bind nuclei. We shall investigate the following other possible processes: (1) mixing of singlet and triplet states of deuteron-like positornium; (2) production of a new kind of nuclear matter with nucleon moments oriented in the field; (3) catalysis of nuclear fission; (4) catalysis of nuclear fusion (with implications for solar neutrinos); and (5) enhancement of forbidden decays like triplet positronium, e.g., fission products.

19428 **(IFUSP-P—370) Giant resonances in heavy-ion reactions.** Hussein, M.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1982. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700701.

The several roles of multipole giant resonances in heavy-ion reactions are discussed. In particular, the modifications in the effective ion-ion potential due to the virtual excitation of giant resonances at low energies, are considered and estimated for several systems. Real excitation of giant resonances in heavy-ion reactions at intermediate energies are then discussed and their importance in the approach phase of deeply inelastic processes in emphasized. Several demonstrative examples are given.

19429 **(IFUSP-P—372) Coherent component of the heavy-ion elastic scattering cross section.** Hussein, M.S.; Salvadori, M.C.B.S. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Nov 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700695.

A new method for the analysis of heavy-ion elastic scattering is suggested. The method is based on a decomposition of the cross-section into a Rutherford, incoherent and coherent components. The incoherent component is directly related to the total reaction cross-section, and may be calculated once the latter is given. Through a careful study of the remaining, coherent, component of the cross-section, one may extract several useful properties of the system. Applications of the scattering of ^{12}C on ^{24}Mg and ^{16}O on ^{28}Si at several energies are made.

19430 (INIS-mf—8696, pp 53-61) **Iterative approach to effective interactions in nuclei.** Heiss, W.D. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Research Inst. for Mathematical Sciences). 1982. NTIS (US Sales Only), PC A08/MF A01. (CONF-8107124—; CONF-8007147—).

From 16. annual seminar on theoretical physics; Port Elizabeth, South Africa (14 Jul 1981).

Starting from a non-linear equation for the effective interaction in a model space, various iteration procedures converge to a correct solution irrespective of the presence of intruder states. The physical significance of the procedures and the respective solution is discussed.

19431 **(INS—452) Treatment of the annihilation interaction in antiproton-nucleus collisions.** Sumiyoshi, H.; Kondo, H.; Uehara, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700703.

We discuss how to treat the annihilation interaction in antiproton-nucleus collisions within the framework of the multiple scattering model under the constraint that real annihilation of the projectile p-bar can take place only once.

19432 (INS-NUMA—29, pp 56-67) **Estimation of secondary neutron yield from heavy ion beam.** Nakamura, Hisashi (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

The measurement and estimation of secondary neutron yield by heavy ion beam bombardment have been studied. The estimations have been done by the use of various computer codes. Those codes were made for the cases of negligible cascade in nuclei, cascade process in nuclei, and cascade process outside nuclei. Comparison of the results of calculation with those of the experimental yield of neutrons with 52 MeV protons was carried out. The agreement between both results was good. At higher energy, better agreement was obtained. When the estimation is made by using the data of secondary protons, the results of the estimation of neutron production will be one half of the true yield. Estimation of the contribution of low energy neutrons is necessary to obtain total neutron yield. Neutron yield spectra, neutron yield in relation to incident particle energy, and neutron multiplicity are shown in figures.

19433 (INS-NUMA—31, pp 43-48) **Physics of projectile fragments. Working group report on the polarization phenomena with heavy ion reactions and beta decay of fragments.** Minamisono, Tadanori (Osaka Univ., Toyonaka (Japan). Faculty of Science). Jan 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8107123—).

From Meeting on measurement in NUMAIRON project and data processing system; Tokyo, Japan (13 Jul 1981).

This is a study report on the polarization phenomena of the projectile fragments produced by heavy ion reactions, and the beta decay of fragments. The experimental project by using heavy ions with the energy from 50 MeV/amu to 250 MeV/amu was designed. Construction of an angle-dispersion spectrograph for projectile fragments was proposed. This is a two-stage spectrograph. The first stage is a QQDQQ type separator, and the second stage is QDQD type. Estimation shows that Co-66 may be separated from the nuclei with mass of 65 and 67. The orientation of fragments can be measured by detecting beta-ray. The apparatus consists of a uniform field magnet, an energy absorber, a stopper, a RF coil and a beta-ray hodoscope. This system can be used for not only this purpose but also for the measurement of hyperfine structure.

19434 **(JAERI-M—82-159) Proceedings of the 2nd joint seminar on atomic collisions and heavy ion induced nuclear reactions.** Harada, Kichinosuke; Ozawa, Kunio; Kamitsubo, H.; Nomura, T.; Awaya, Y.; Watanabe, T. (eds.). (Japan Atomic Energy Research Inst., Tokyo). Nov 1982. 190p. (In Japanese). (CONF-8205246—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE84700704.

From 2. joint seminar on atomic collisions and heavy ion induced nuclear reactions; Tokyo, Japan (13 May 1982).

The meeting of the 2nd joint seminar on atomic collisions and heavy ion induced nuclear reactions was held at the University of Tokyo, May 13 and 14, 1982. The aim of this seminar has been not only to recognize the common problems lying between above two research fields, but also to obtain an overview of the theoretical and experimental approaches to clear the current problems. In the seminar, more than 50 participants gathered and presented 16 papers. These are two general reviews and fourteen comprehensive surveys on topical subjects which have been developed very intensively in recent years. The editors would like to thank all participants for their assistance and cooperation in making possible a publication of these proceedings.

19435 **(JAERI-M—83-025) Prediction of mass excess, β-decay energy and neutron separation energy from the atomic mass formula with empirical shell terms.** Ando, Yoshihira; Uno, Masahiro; Yamada, Masami. (Japan Atomic Energy Research Inst., Tokyo). Feb 1983. 145p. (NEANDC(J)—89/U; INDC(JAP)—76/L). NTIS (US Sales Only), PC A07/MF A01. Order Number DE84700705.

Recently we proposed two types of atomic mass formula (constant-shell-term formula, linear-shell-term formula). With use of these formulas, we calculate and tabulate mass excesses, neutron separation energies, and β-decay energies (β^--decay and/or electron capture) for about 5000 nuclides. The mass excess values and their errors in the 1977 atomic mass evaluation by A.H. Wapstra and K. Bos which we used in constructing our formulas, are also tabulated for reference. The constant-shell-term formula is fitted to 1468 input mass data with the standard deviation of 626 keV and the linear-shell-term formula with 394 keV.

19436 (JAERI-M—9999, pp 125-134) **Systematics of β-decay strength functions and the delayed neutron emission.** Tachibana, Takahiro (Waseda Univ., Tokyo (Japan). School of Science and Engineering). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8111184—; NEANDC(J)—81/U; INDC(JAP)—68/L).

From Seminar on nuclear data; Tokai, Ibaraki, Japan (26 Nov 1981).

An attempt is made to deduce the β-decay strength function of the nucleus with N_1 neutrons and Z_1 protons ((N_1, Z_1)nucleus) from β-decay data on the three neighboring nuclides, $(N_1, Z_1 + 1)$, $(n_1 - 2, Z_1)$, and $(N_1 - 2, Z_1 + 1)$. This approach is considered to be most effective when N_1 equals to a magic number plus two and Z_1 is odd, and can be applied to the delayed neutron emission of some nuclides. In particular, the delayed neutron emission probability (strictly speaking, its lower limit) is calculated to be 2.55% for ^{87}Br and 3.3% for ^{137}I (experimental values are 2.57% and 6.7%, respectively).

19437 (JAERI-M—9999, pp 268-292) **Present status of gamma-ray production nuclear data measurements.** Igashira, Masayuki (Tokyo Inst. of Tech. (Japan)). Mar 1982. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. (CONF-8111184—; NEANDC(J)—81/U; INDC(JAP)—68/L).

From Seminar on nuclear data; Tokai, Ibaraki, Japan (26 Nov 1981).

A survey of measurements of the gamma-rays from neutron induced reactions is presented. Capture gamma-ray data are described somewhat in detail with the inclusion of our recent experi-

mental results. It is shown that data of capture and nonelastic gamma-rays are still inadequate to make a gamma-ray production nuclear data library.

19438 **(JINR—E-4-82-726) Program for calculation of the E1, E2 and M1 transition probabilities in odd-odd nuclei taking the Coriolis mixing into account.** Hons, Z.; Kvasil, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700707.

A computer program for calulation of the E1, E2 and M1 reduced transition probabilities in deformed odd-odd nuclei is given. The program is written as an FCN subroutine for the MINUIT minimizing program. The program is based on the "two quasi-particles + rotor" model with inclusion of the Coriolis coupling. In order to take the Coriolis coupling into account, thw matrix of the total Hamiltonian is constructed and diagonalized. The Jacobi diagonalization method is used in the search for eigenvalues and eigenvectors for all spin values required. Simultaneously the optimization of all the parameters is carried out by a least-square fit to the experimental energy levels is obtained.

19439 **(JINR-R—16-82-629) Neutron production double differential cross section approximation in heavy ion reactions at the energies up to 100 MeV/nucleon.** Tsovbun, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of Radiation Safety). 1982. 6p. (In Russian). (CONF-8210133—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700693.

From 8. All-Union conference on charged particles accelerators; Protvino, USSR (19 Oct 1982).

An approximate expression for evaluating the neutron production cross section in heavy ion reactions is obtained. On the base of the comparison of the suggested expression with experimental data the conclusion is made that the approximation used is available for determining the neutron doses in front of and behind concrete shield of heavy ion accelerators for wide ranges of energy, ion types and target materials.

19440 **(Juel—1859) Investigation of fission models for high-energy radiation transport calculations.** Armstrong, T.W.; Cloth, P.; Filges, D.; Neef, R.D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jul 1983. 74p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84750877.

An investigation of high-energy fission models for use in the HETC code has been made. The validation work has been directed checking the accuracy of the high-energy radiation transport computer code HETC to investigate the appropriate model for routine calculations, particularly for spallation neutron source applications. Model calculations are given in terms of neutron production, fission fragment energy release, and residual nuclei production for high-energy protons incident on thin uranium targets. The effect of the fission models on neutron production from thick uranium targets is also shown.

19441 **(KFK—3586) Density dependence of the effective alpha-nucleon force and isoscalar transition rates of nuclei.** Srivastava, D.K.; Rebel, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Kernphysik). Sep 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750737.

Effects of the density-dependence of the α-particle - bound nucleon effective interaction on single-folding models of inelastic α-particle scattering are studied, in particular in view of corrections of the isoscalar transition rates extracted by implicit folding procedures. The 1-dependent correction factors C_1 are calculated and tabulated for applications.

19442 (ZfK—491, pp 88-95) **Energetic heavy ion collisions and the properties of hot nuclear matter.** Schulz, H.; Muenchow, L. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Roepke, G.; Schmidt, M. (Rostock Univ. (German Democratic Republic)). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

Relying on a model calculation based mainly on a simple nucleon-nucleon interaction of the Skyrme type and on a perturbation treatment of the motion of composites in a hot nuclear medium, some of the interesting properties of hot nuclear matter as produced in the course of an energetic heavy ion collision are discussed. Especially, the cluster composition at given temperature and density, the phase stability of hot matter, the entropy problem, the phase transition below T = 20 MeV and the Bose condensation of α-particles are studied. The comparison with data obtained from energetic heavy ion collisions permits one to test the equation of state in a new domain.

19443 (ZfK—491, pp 102-109) **Use of a transport equation for the dynamical behaviour of the nuclear fission.** Scheuter, F.; Gregoire, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

A Fokker Planck equation is used for the problem of nuclear fission. The decay rate is computed within a three dimensional calculation and the influence of coupling terms in the transport coefficient tensors is considered. Initial conditions at the saddle point for the collective degrees of freedom are dynamically obtained in the stationary situation. Finally, dynamics of fluctuations from saddle to scission is treated under the same assumptions on the propagation.

19444 (ZfK—491, pp 155-179) **Evaluation of neutron nuclear reaction data for fissionable nuclei using nuclear theory.** Uhl, M. (Vienna Univ. (Austria)). Dec 1982. NTIS (US Sales Only), PC A10/MF A01. (CONF-821197—).

From 12. international symposium on nuclear physics; Gaussig, German D.R. (22 Nov 1982).

Nuclear model calculations of neutron cross section data are reviewed with emphasis on elastic and inelastic scattering, fission and prompt fission neutron spectra. The role of the model parameters is discussed.

19445 **Relative quality of the spin expansion and frequency expansion for the description of rotational level energies.** Peker, L.K.; Pearlstein, S. (Brookhaven National Lab., Upton, NY (USA)); Hamilton, J.H. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Physics). *Journal of Physics G: Nuclear Physics;* **9**: No. 9, 1025-1032(Sep 1983).

The expansions in terms of angular momentum I or angular frequency ω that describe the energies of the levels in the ground-state rotational bands with Ksup(π)=O^+ are generally not equivalent unless $n_1=n_2=1$ or infinity. A method is proposed to characterise this non-equivalency quantitatively. It was found that in some nuclei, like ^{248}Cm and ^{166}Er, the I(I + 1) expansion is better than the ω^2 expansion, whereas in the majority of nuclei the ω^2 expansion is better. The data demonstrate that the rates of convergence of the I(I + 1) and ω^2 expansions for Esub(rot) depend on the individual properties of the nuclei.

19446 **Nuclear dissipation in heavy-ion reactions and fission.** Nix, J.R. (Los Alamos National Lab., NM (USA)). *Comments on Nuclear and Particle Physics;* **12**: No. 1, 13-27(Jul 1983).

Influenced by both mean-field effects and two-particle collisions, nuclear dynamics displays a richness ranging from elastic vibrations of solids to long mean-free-path dissipative fluid flow with statistical fluctuations. Confrontation of recent and planned experiments with new theoretical calculations is helping determine the

magnitude and mechanism of dissipation in large amplitude collective nuclear motion.

6540 Radiation And Shielding Physics

19447 **(BNL—34250) Interference coatings for neutrons.** Majkrzak, C.F. (Brookhaven National Lab., Upton, NY (USA)). Jan 1984. Contract AC02-76CH00016. 10p. (CONF-840494—5). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007376.

From Topical meeting on optical fabrication and testing; Monterey, CA, USA (18 Apr 1984).

A review of multibilayer thin film devices for monochromating and/or polarizing neutrons with wavelengths of the order of 1A and longer is given.

19448 **(EFI—564(51)-82) Simulation of electron transport in a matter by the Monte-Carlo Method.** Margaryan, A.T. (Erevanskij Fizicheskij Inst. (USSR)). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700694.

A model of electron transport based on the collision grouping scheme is proposed which describes well the regularities observed in the experiment for electrons with energies both above 10 keV and of keV order.

19449 (INIS-SU—198, pp vp) **Applicability limits of positron energy loss theory in a matter.** Grupper, A.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19450 (INIS-SU—198, pp vp) **Positron scattering by thin metal films.** Grupper, A.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19451 (INIS-SU—198, pp vp) **Radiation energy losses while high-energy electrons pass through monocrystals.** Vnukov, I.E.; Zabaev, V.N.; Kalinin, B.N.; Kuskov, A.A.; Potylitsyn, A.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19452 (INIS-SU—198, pp vp) **Space charge effect on electron absorption in dielectrics.** Zajtsev, R.Ya.; Smirnov, V.V. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19453 (INS-NUMA—29, pp 19-27) **Measurement of stopping power of heavy ions.** Kitahara, Tetsuo (Yamanashi Medical Coll. (Japan)). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

The stopping power of heavy ions is discussed. In the low energy region, heavy ions keep some of their orbital electrons, and have equilibrium electron charge. The stopping power of penetrating particles depends on this effective charge. At present, it is hard to estimate this effective charge theoretically, accordingly, the estimation is made experimentally. Another difficulty in this estimation is that the Born approximation is not effective for heavy ions. In the low energy region, electronic stopping and nuclear stopping contribute to the stopping power. For the electronic stopping, a formula for the stopping power was given by Lindhard et al. The experimental values were obtained at GSI, and are inconsistent with the estimation by the Lindhard's formula. In the high energy region, where the Born approximation can be used, the Bethe's formula is applied, but the experimental data are scarce. Oscillations are seen in the Z dependence graph of the experimental stopping cross sections. Experimental works on the stopping power have been done. The differential and the integral methods were carried out.

19454 (INS-NUMA—29, pp 28-32) **Measurement of stopping power of light ions.** Sakamoto, Naoki (Nara Women's Univ. (Japan). Dept. of Physics). Jul 1981. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107122—).

From Meeting on heavy and light ion irradiations and radiation measurement; Tanashi, Tokyo, Japan (2 Jul 1981).

The stopping power of light ions penetrating various materials has been measured. The data of proton stopping power and the mean ionization potentials are presented. The experiments were made by using the 6.75 MeV protons from a cyclotron and the protons in the energy range from 3 to 9 MeV from a tandem Van de Graaff. The windows with and without sample-foils were rotated in front of a semiconductor detector, and the measured energy loss and the thickness of the sample foils were used to estimate the energy loss at the mean energy of protons in the samples. The analyses were made by considering the inner shell correction, Z_1^3 correction and the Bloch correction. The mean ionization potentials were derived from the data.

19455 **(JAERI-M—82-199) Vector processing of the neutron transport codes.** Ishiguro, Misako; Tsutsui, Tsuneo. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 46p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700692.

One of the large computations in JAERI is the neutron transport ones used for reactor shielding and criticality analyses. The adaptability of vector processings has been investigated on the neutron transport codes under the assumption of future use of super-computer. Five codes have been tested. They are DOT3.5, TWOTRAN and ANISN based on finite difference method, and PALLAS-2DCY and BERMUDA on the direct integration method. It has been found that the gain from vectorization depends upon the numerical methods, geometries, and problems types to be solved. That is, the direct integration is rather suited for vector processing. But in the conventional finite difference method, the difference equation has an unvectorizable recurrence form in (r, z) and (r, -)-geometries. But by altering the interative process, the equation can be vectorized and some gains have been found to be achieved in a criticality problem. For each code, described are some views on vectorization, program restructurings, speedup ratio on F75 APU, numerical studies on the interative process, and so forth.

19456 **(LA-UR—83-2150) Variational methods in steady state diffusion problems.** Lee, C.E.; Fan, W.C.P.; Bratton, R.L. (Los Alamos National Lab., NM (USA); Texas A and M Univ., College Station (USA). Dept. of Nuclear Engineering). 1983. Contract W-7405-ENG-36. 26p. (CONF-830932—7). NTIS, PC A03; 3; GPO Dep. Order Number DE83015221.

From International conference on numerical methods in nuclear engineering; Montreal, Canada (6 Sep 1983).

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Classical variational techniques are used to obtain accurate solutions to the multigroup multiregion one dimensional steady state neutron diffusion equation. Analytic solutions are constructed for benchmark verification. Functionals with cubic trial functions and conservational lagrangian constraints are exhibited and compared with nonconservational functionals with respect to neutron balance and to relative flux and current at interfaces. Excellent agreement of the conservational functionals using cubic trial functions is obtained in comparison with analytic solutions.

19457 **(ORNL/TM—8987) Initial electron energy spectra in water irradiated by photons with energies to 1 GeV.** Todo, A.S.; Hiromoto, G.; Turner, J.E.; Hamm, R.N.; Wright, H.A. (Oak Ridge National Lab., TN (USA)). Feb 1984. Contract W-7405-ENG-26. 56p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84007564.

This work was undertaken to provide basic physical data for use in the dosimetry of high-energy photons. Present and future sources of such photons are described, and the relevant literature is reviewed and summarized. Calculations were performed with a Monte Carlo computer code, PHOEL-3, which is also described. Tables of initial electron and positron energies are presented for monoenergetic photons undergoing single interactions in water. Photon energies to 1 GeV are treated. The code treats explicitly the production of electron-positron pairs, Compton scattering, photoelectric absorption, and the emission of Auger electrons following the occurrence of K-shell vacancies in oxygen. The tables give directly the information needed to specify the absolute single-collision kerma in water, which approximates tissue, at each photon energy. Results for continuous photon energy spectra can be obtained by using linear interpolation with the tables. (Continuous spectra can also be used directly in PHOEL-3.) The conditions under whch first-collision kerma approximate absorbed dose are discussed. A formula is given for estimating bremsstrahlung energy loss, one of the principal differences between kerma and absorbed dose in practical cases. 31 references, 4 figures, 18 tables.

6550 Medical Physics

REFER ALSO TO CITATION(S) 18968, 19019

19458 **(AD-A—136625/1) Gamma-ray exposure hazard due to stowage of M-774 APFSDS (Armour-piercing fin-stabilized discarding-sabot) rounds in a Leopard C-1 main battle tank. Technical note.** Robitaille, H.A. (Defence Research Establishment, Ottawa, Ontario (Canada)). Sep 1983. 14p. (DREO-TN—82-32). NTIS, PC A02/MF A01.

The M-744 APFSDS anti-tank round contains a depleted-uranium penetrator of 3.4 kgram mass. Since depleted uranium is naturally radioactive, the storage of a substantial number of these rounds inside a Leopard C-1 main battle tank creates a gamma radiation field within the vehicle. Gamma-ray exposure rates have been measured using a sodium-iodide spectrometer at each of the four crew-member locations and for two turret orientations, with 59 rounds stowed in the vehicle. In all cases the measured gamma-ray dose rates were less than a maximum of 0.17 millirad per hour observed at the loader's position. Assuming the loader spent an entire week (168 hours) at his station, his integrated dose would amount to 29 mRad - approximately a factor of 4 lower than the maximum currently allowed by Canadian Forces regulations. It is therefore concluded that the M774 round does not represent a significant gamma radiation hazard to Leopard C1 crewmembers.

19459 **(IFE/KR/E—82/009V) Dose criteria, a sensitive analysis.** Tveten, U. (Institute for Energy Technology, Kjeller (Norway)). Nov 1982. 12p. (NKA/REK—1(82)403). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700103.

The report is concerned with part of a subproject under a Nordic project called "Large reactor accidents;consequences and mitigating actions". The subproject is concerned with action levels (dose criteria, reference levels). The problems connected to definition and use of dose criteria are highlighted, and the purpose of the subproject is to provide an improved basis for discussion between Nordic authorities on suitable action levels. The sensitivity analysis that is reported on in the present report, relates to the relationship between action level, economic consequences and health consequences. The reported calculations show that when the dose criteria are varied, the calculated health as well as economic consequences vary accordingly. The calculations also show that a certain sum in monetary terms spent in different ways will give strongly different benefits in the form of health consequences avoided.

19460 **(KFKI—1983-47) Elliptic phantom measurements and calculations of neutron spectra and dose distributions for ^{252}Cf and heavy-water-moderated ^{252}Cf sources.** Palfalvi, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1983. 18p. (In Hungarian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700109.

Calculations and measurements for the dose distribution in a water-filled elliptical phantom when irradiated with neutrons of bare and heavy-water moderated Californium neutron sources are presented. The calculations were performed by a Monte-Carlo code, for the measurements different nuclear track detectors were used.

19461 (NUREG/CP—0041-Vol.3, pp 258-263) **New data and perspectives on radiation risk comparisons.** Zanetos, M.A. (Battelle Columbus Labs., OH). Jan 1983. NTIS, PC A22/MF A01 - GPO $8.50. (CONF-821037—Vol.3).

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

A discussion is presented concerning the adequacy of the maximum permissible dose of 5 rem/year in affording sufficient protection for radiation workers. The problems encountered in attempting to make comparative assessments of the risks faced by these workers versus their counterparts in other industries are discussed.

19462 **(TGL—25295/01) Package for transport of radioactive materials. Definition and classification.** (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Dec 1981. 15p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700104.

The standard contains the definitions of 47 terms relevant to safety aspects in the transport of radioactive materials and a classification scheme of transport packagings for such materials. Alphabetical indexes are added in Bulgarian, Hungarian, Polish, Romanian, Russian and Czech.

19463 **(TGL—30665/01) Sources of ionizing radiation. Safety-conscious behaviour, definitions.** (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Dec 1981. 3p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700105.

The standard contains the definitions of 30 terms relevant to radiation protection in the application of X radiation and sealed sources in medicine and industry.

19464 **(TGL—30665/03) Sources of ionizing radiation. Handling with sealed sources, safety-conscious behaviour.** (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Dec 1981. 4p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700106.

Proceeding from general safety requirements to be met in handling sealed sources, instructions are given for the safe operation of control engineering and of gamma defectoscopy equipment; for the handling of sealed sources in contact radiotherapy; and for the operation of teletherapy installations and of well irradiation devices.

6560 Solid State Physics

19465 **(CONF-840264—1-Draft) Theoretical study of neutron scattering cross sections in semiconductors.** Cooke, J.F.; Blackman, J.A.; Morgan, T. (Oak Ridge National Lab., TN (USA)). Jan 1984. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007540.

From Workshop on high energy excitations in condensed matter; Los Alamos, CA, USA (13 Feb 1984).

The development of high-flux high-energy pulsed-neutron sources makes it possible to study electronic transitions in solids which are in the electron volt range. A theoretical study has been carried out to determine the feasibility of using such sources to obtain information about the band structure of semiconductors. Calculations of the inelastic neutron scattering cross sections for germanium and silicon based on an empirical pseudopotential description of the energy bands have been completed. No significant structure associated with the band gap was found in the calculational results. The calculated cross sections also were found to be quite small for realistic experimental conditions. Measurement of these relatively small cross sections could, however, provide important

information about the band structure of semiconductors which can not be obtained from most other experimental techniques. 10 references.

19466 (INIS-mf—8696, pp 137-145) **Cellular approach to band structure calculations.** Verwoerd, W.S. (South Africa Univ., Pretoria). 1982. (In Afrikaans). NTIS (US Sales Only), PC A08/MF A01. (CONF-8107124—; CONF-8007147—).

From 16. annual seminar on theoretical physics; Port Elizabeth, South Africa (14 Jul 1981).

A short introduction to the cellular approach in band structure calculations is given. The linear cellular approach and its potantial applicability in surface structure calculations is given some consideration in particular.

19467 (INIS-SU—196, pp 49-50) **Peculiarities of relativistic particle elastic scattering in monocrystal.** Shul'ga, N.F.; Truten', V.I.; Fomin, S.P. 1982. (In Russian). NTIS (US Sales Only), PC A05/MF A01. (CONF-8105209—No.1(19)).

From All-union seminar electromagnetic interactions of hadrons in the resonance energy range; Khar'kov, Ukrainian SSR (26 May 1981).

The process of multiple scattering of relativistic charged particles moving in a crystal at a small angle to one of the crystallographical axes is considered. It is revealed that the angle mean square of particle multiple scattering in a crystal may essentially exceed the angle mean square of particle multiple scattering in amorphous medium.

19468 (INIS-SU—198, pp vp) **Superpenetration of potential barriers.** Zakhar'ev, B.N. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19469 (INIS-SU—198, pp vp) **Band mechanism of relativistic particle reflection from crystal surface.** Khlabutin, V.G.; Vorob'ev, S.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19470 (INIS-SU—198, pp vp) **Coherent Coulomb excitation of channeled nuclei in crystals.** Pivovarov, Yu.L.; Shitokov, A.A. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19471 (INIS-SU—198, pp vp) **Psub(s) polarons in ionic crystals.** Prokop'ev, E.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19472 (INIS-SU—198, pp vp) **Froelich model for polaron state of a positron in a crystal.** Maloyan, A.G.; Prokop'ev, E.P. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

19473 (INIS-SU—198, pp vp) **Theoretical expressions for analysis of near-to-surface layers of solids by Moessbauer characteristic remission radiation spectroscopy.** Babikova, Yu.F.; Kolpakov, N.S.; Nilov, K.E.; Shtan', I.I. 1983. (In Russian). NTIS (US Sales Only), PC A99/MF A01. (CONF-8304144—Summs.).

From 23. conference on nuclear spectroscopy and nuclear structure; Moscow, USSR (19 Apr 1983).

6561 Superconductivity

REFER ALSO TO CITATION(S) 18809, 18897

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 19270, 19350

19474 **(DESY-L-Trans—279) Correlation between Lorentz-Dirac and Klein-Gordon equations.** Sermyagin, A.V. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84750513.

Existence of unphysical solutions of the classical relativistic Lorentz-Dirac (I.D) equation allowing for the radiation reaction of proper electromagnetic field of charge is considered usually as nonsense. It is suggested to treat the paradox of the afteracceleration or runaway solution of LD equation as a prototype of some sort quantum properties, namely the relativistic Zitterbewegung of Schroedinger. This permits by utilizing the D'Alembertian representation in derivations with respect to retarded and advanced proper time to get from the massless free LD equation the Klein-Gordon equation for vector wave function ksup(i) under condition k^{1}ksub(i)=0. The possibility ratio of world constants is also considered.

19475 **(INIS-mf—8340) Quantization procedure for systems of identical particles. Borel kinematics and parastatitics.** Tahiri, M. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 20 Jul 1982. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84780101.

In the present thesis a geometrical quantization procedure of systems of identical particles is developed which takes into account the special topology of this system.

19476 (INIS-mf—8696, pp 49-52) **Schroedinger evolution operator expanded exponentially.** Vermeulen, J.J.C.; Scheffler, T.B. 1982. NTIS (US Sales Only), PC A08/MF A01. (CONF-8107124—; CONF-8007147—).

From 16. annual seminar on theoretical physics; Port Elizabeth, South Africa (14 Jul 1981).

A formal solution of the Schroedinger evolution equation in exponential form is given. Arbitrary nn Pade approximation to the evolution operator is shown to be unitary and bounded, and to lead to a stable implicit numerical method for solving the time-dependent Schroedinger equation.

19477 (INIS-mf—8703, pp vp) **Propagator of a damped quantum-mechanical oscillator.** Exner, P.; Kolerov, G.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19478 (INIS-mf—8703, pp vp) **Dynamics of open quantum-mechanical systems and rigorous Feynman integrals.** Exner, P.; Kolerov, G.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19479 (INIS-mf—8703, pp vp) **Analytic solution of the quantum-mechanical problem of anharmonic oscillations.** Znojil, M. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 19374

19480 **(DOE/ER/12001—T1) Computational modeling and mathetmatics applied to the physical sciences.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). 1984. Contract FG01-81ER12001. 102p. NTIS, PC A06/MF A01; GPO Dep. Order Number DE84008252.

The principal conclusion of this committee is that computational modeling, which is a high-leverage element of our nation's scientific and technological effort, requires increased emphasis and support. The conclusion is documented by an examination of typical application areas, which reveals the pervasive difficulties that accompany computation of realistic problems and leads one to consider both what computers can do and what they cannot currently do but might eventually be capable of doing. The Committee recommends increased support for research in computational modeling and applied mathematics, computing facilities dedicated to this area, and education and manpower development in computational and applied mathematics. These recommended increases include financial support from government and industry as well as institutional support from universities.

19481 **(RIMS—190) Relative entropy and its applications.** Araki, H. (Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences). Aug 1975. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84900757.

The purpose of this review is to show usefulness of relative entropy by two examples of its applications to statistical mechanics.

19482 **(RIMS—191) Relative entropy of states of von Neumann algebras.** Araki, H. (Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences). Sep 1975. 37p. NTIS (US Sales Only), PC AA03/MF A01. Order Number DE84900758.

Relative entropy of two states of a von Neumann algebra is defined in terms of the relative modular operator. The strict positivity, lower semi-continuity, convexity and monotonicity of relative entropy are proved. The Wigner-Yanase-Dyson-Lieb concavity is also proved for general von Neumann algebra. 15 references.

6590 Communication, Education, History, And Philosophy

19483 **(LALP—83-47) First chain reaction.** Anderson, H.L. (Los Alamos National Lab., NM (USA)). Dec 1983. Contract W-7405-ENG-36. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007995.

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An historical account of the events leading up to and including the first chain reaction at the University of Chicago from the perspective of Herbert L. Anderson is given. (WHK)

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 19001, 19548, 19563, 19564

19484 **(AD-A—134759/0) Variation of laser absorption with plasma scalelength in long-scalelength plasmas. Memorandum report.** Herbst, M.J.; Grun, J.; Gardner, J.; Stamper, J.A.; Young, F.C. (Naval Research Lab., Washington, DC (USA)). 30 Sep 1983. 12p. (NRL-MR—5186). NTIS, PC A02/MF A01.

A short-pulse, high-intensity Nd-laser beam interacts with preformed plasmas of variable scalelength. At the longest scalelength, absorption is limited by backscatter, despite increased collisional absorption.

19485 **(AD-A—135173/3) Interaction of electromagnetic fields with plasma. Final report 1 Oct 78-31 Dec 82.** Cheo, B.R.; Kuo, S.P.; Poole, B.R. (Polytechnic Inst. of New York, Farmingdale (USA). Dept. of Electrical Engineering). Aug 1983. 46p. NTIS, PC A03/MF A01.

Essentially five topics were studied during this time period; three are essentially experimental investigations, and the other two are theoretical in nature. The five topics include: 1) Propagation of microwaves along a plasma column and harmonic generation of electrostatic ion cyclotron waves, 2) Imploding tube experiment, 3) RF Generated Current in a Magnetized Plasma Using a Slow Wave Structure, 4) Wave-Particle interaction at cyclotron resonances, and 5) Turbulent interaction between waves and charged particles.

19486 **(AD-A—135538/7) Nonlinear mode coupling theory of the lower-hybrid-drift instability. Memorandum report.** Drake, J.F.; Guzdar, P.N.; Hassam, A.B.; Huba, J.D. (Naval Research Lab., Washington, DC (USA)). 25 Nov 1983. 47p. (NRL-MR—5209). NTIS, PC A03/MF A01.

A nonlinear mode coupling theory of the lower-hybrid-drift instability is presented. A two-dimensional nonlinear wave equation is derived which describes lower-hybrid drift wave turbulence in the plane transverse to B ($k.B = 0$), and which is valid for finite beta, collisional and collisionless plasmas. The instability saturates by transferring energy from growing, long wavelength modes to damped, short wavelength modes. Detailed numerical results are presented which compare favorably to both recent computer simulations and experimental observations. Applications of this theory to space plasmas, the earth's magnetotail and the equatorial F region ionosphere, are discussed.

19487 **(AD-A—135787/0) NRL (naval research laboratory) plasma formulary. Revised.** Book, D.L. (Naval Research Lab., Washington, DC (USA)). 1983. 61p. (NRL-MR—3332-SUPPL). NTIS, PC A04/MF A01.

Most of the formulas and data in this collection are well known and for all practical purposes are in the public domain. The books and articles cited are intended primarily not for the purpose of giving credit to the original workers, but (i) to guide the reader to sources containing related material and (ii) to indicate where derivations, explanations, examples, etc., omitted from this compilation can be found. Additional material can also be found in D.L. Book, NRL Memorandum Report 3332 (1977).

19488 **(DOE/DP/40124—20) Short-pulse, short-wavelength optical probe for laser plasma.** Seka, W.; Hoose, J. (Rochester Univ., NY (USA). Lab. for Laser Energetics). Mar 1984. Contract AC08-80DP40124. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008336.

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This report is a detailed proposal for a short pulse, short wavelength, optical probe which can be synchronized with either GDL or OMEGA. Typical probe laser parameters are $\lambda \sim 2000$ A, $t \approx 2$ ps, with an energy of several hundred μJ and synchronization of 20 to 50 ps. The present design is based on detailed experimental work done over the past two years in the Picosecond Group at LLE.

19489 **(DOE/ET/51013—113) Spectral measurements of fluctuating ω/sub pe/ radiation from Alcator C tokamak.** Gandy, R.F.; Yates, D. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 28 Feb 1984. Contract AC02-78ET51013. 20p. (PFC/RR—84-4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007976.

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High resolution spectral measurements have been made of the fluctuating electron plasma frequency (ω/sub pe/) radiation from Alcator C. Three techniques have been used in making the measurements. Features as narrow as 350 kHz have been observed ($\Delta f/f \approx 6 \times 10^{-6}$), impling that a highly coherent process is responsible for the emission.

19490 **(DOE/ET/53088—128) Free-boundary stability of straight stellarators.** Barnes, D.C.; Cary, J.R. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Feb 1984. Contract FG05-80ET53088. 60p. (IFSR—128). NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84008272.

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The sharp-boundary model is used to investigate the stability of straight stellarators to free-boundary, long-wavelength modes. To correctly analyze the heliac configuration, previous theory is generalized to the case of arbitrary helical aspect ratio (ratio of plasma radius to periodicity lengths). A simple low-β criterion involving the vacuum field and the normalized axial current is derived and used to investigate a large variety of configurations. The predictions of this low-β theory are verified by numerical minimization of δW at arbitrary β. The heliac configuration is found to be remarkably stable, with a critical β of over 15% determined by the lack of equilibrium rather than the onset of instability. In addition, other previously studied systems are found to be stabilized by net axial plasma current.

19491 **(INIS-mf—4754(no.22)) International bulletin on atomic and molecular data for fusion. No. 22.** Katsonis, K. (ed.). (International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit). May 1983. 68p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84780109.

This bulletin deals with atomic and molecular data for fusion. Work in progress is briefly reported (charge exchange of slow ionized ions with neutral gases, cross section for electron impact ionization of Alt). The bulletin contains a list of references covering the years 1981, 1982 and 1983 for publications on controlled thermonuclear fusion and plasma physics.

19492 (INIS-mf—8703, pp vp) **Measurement of electron energy distribution function in time variable low temperature plasma.** Sicha, M. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

NONE

19493 (INIS-mf—8703, pp vp) **Fokker-Planck equation for plasma in strong magnetic field.** Sestak, B. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19494 (INIS-mf—8703, pp vp) **Magnetic Rosenbluth potentials.** Sestak, B. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19495 (INIS-mf—8703, pp vp) **Generalized barometric formula for collisional plasma in magnetostatic and hf fields.** Klima, R.; Krlin, L. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19496 (INIS-mf—8703, pp vp) **Influence of high frequency fields on flow of impurities in plasma.** Petrzilka, V.A. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19497 (INIS-mf—8703, pp vp) **Expanding plasma characteristics measured with two-channel microwave interferometer.** Kalivoda, L.; Rosenkranz, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Elektrotechnicka). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19498 (INIS-mf—8703, pp vp) **Charged particle transport to non-conducting wall as function of electric sheath parameters.** Teplanova, K.; Kosinar, I.; Martisovits, V. (Komenskeho Univ., Bratislava (Czechoslovakia). Prirodovedecka Fakulta). 1981. (In Slovak). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19499 (INIS-mf—8703, pp vp) **Equipment for plasma diagnostics using Thomson scattering of laser radiation.** Babicky, V.; Kolacek, K. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19500 **(JAERI-M—82-113) Destruction of magnetic surfaces by high-n ballooning mode.** Tuda, Takashi; Itoh, Kimitaka; Itoh, Sanae. (Japan Atomic Energy Research Inst., Tokyo). Sep 1982. 13p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700654.

Effects of high-n ballooning modes on plasma confinement are examined. Kinetic effects or finite-resistivity should cause reconnection of the field lines and magnetic surfaces of the tokamak are destroyed by the ballooning instabilities. Tearing parity modes are important for the magnetic surface destruction. The diffusion coefficient of the field line is linearity proportional to the amplitude of the perturbed field. Beta limitation of tokamak systems by the ballooning mode is discussed.

19501 **(LA—9872-MS) Electrical conductivity of an arbitrarily dense plasma.** Rinker, G. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 80p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84008006.

This is the first of a series of papers concerning the electrical and thermal transport properties of dense plasmas. Temperatures and densities considered range from zero to 2^{13} eV and 2^{-13} to 2^{13} times compressed. In the present work we describe theoretical calculations of electrical conductivities using the t-matrix version of the Ziman theory with various self-consistent ionic potential models. The theoretical basis is described and illustrative results are given.

19502 **(LA-UR—84-583) Parameters of a possible FRC adiabatic compression experiment.** Tuszewski, M.; Siemon, R.E. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840255—6). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007487.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

An experiment is described that would address the following research goals for field-reversed configurations (FRC). (a) Test FRC stability with a number of ion gyroradii relative to the plasma radius substantially greater than in present experiments. (b) Increase the electron temperature sufficiently to test the physics of electron energy confinement and of trapped-flux losses. (c) Improve confinement while remaining in a density regime ($n \leqq 5 \times 10^{15}$ cm^{-3}) most likely to be relevant to fusion power production.

19503 **(LA-UR—84-584) Recent results on the FRC transport.** Tuszewski, M. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840255—7). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007482.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

Some recent transport studies of field-reversed configurations (FRC) during their equilibrium phase are presented. The FRC confinement times of interest tau/sub N/, tau/sub E/, and tau/ sub phi/ are for particles, energy, and trapped-flux, respectively. An analytical expression for tau/sub N/ based on Lower-Hybrid-Drift (LHD) resistivity is presented. Some progress in assessing the respective contributions of radiation and thermal conduction to tau/ sub E/ is given. Finally, the relation tau/sub E/ $\leqq$ tau/sub phi/ is discussed.

19504 **(LA-UR—84-601) Interaction of the neutral deuterium flux with a field-reversed configuration.** Rej, D.J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840255—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007488.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

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Recycling effects arising from the penetration of cold neutrals into a hot plasma has been known to contribute to confinement properties of tokamaks, mirrors, RFPs, and spheromaks. To data, however, ionization and charge exchange processes associated with the possible influx of neutrals have been neglected in FRC transport models, or their effects have been found negligible for experiments with short lifetimes ($< 20\ \mu s$). These processes are also neglected when ascertaining the experimental particle confinement time tau/sub N/. As experimental FRC lifetimes have recently been extended to record values ($\geqq 300\ \mu s$), these effects on transport may no longer be negligible. Furthermore, these losses can be enhanced when FRCs translate at axial speeds much greater than the thermal speeds of the neutrals. The purpose of this analysis is to examine the interaction of neutral deuterium with an FRC. The relevant atomic and molecular processes are reviewed. A simple, steady-state, multi-species 1-D (radial) neutral transport model is described and applied to FRC plasma parameters observed earlier. Estimates of the power loss due to these neutrals are made for both stationary and translating plasmas.

19505 **(MPQ—75) LAPLAS - a one-dimensional code for laser plasma simulations.** Schmalz, R.F.; Mulser, P.; Spindler, G. (Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)). Jul 1983. 43p. Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.).

This report describes in detail a FORTRAN programm called LAPLAS which was developed to support the laser plasma experiments carried out at MPQ. LAPLAS is a one-dimensional finite difference Lagrange code which solves the gasdynamical equations allowing for two temperatures (electronic and ionic). The formulation is explicit for the hydrodynamics and implicit in the energy equations. A tabulated equation of state is used.

19506 **(TRITA-EPP—83-03) Thermal effects on surface ripple charges for waves on a plasma column.** Raadu, M.A. (Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics). Apr 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700669.

Plasma waves on a cylindrical plasma column lead to ripples on a free boundary. These ripples may be treated as an equivalent surface charge. A general expression including thermal effects is derived for this charge which reduces to the known results in the cold case. Explicit expressions with limiting forms for high temperatures are derived for the case of Maxwellian and water bag distributions.

19507 **(TRITA-EPP—83-05) Spontaneous transfer of magnetically stored energy to Kinetic energy by electric double layers.** Lindberg, L.; Torven, S. (Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics). May 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700670.

Current disruptions are investigated in a magnetized plasma column with an inductive external electric circuit. It is found that they persist in spite of the fact that each disruption gives rise to a large inductive over-voltage. This drops off at an electric double layer formed in the plasma where most of the magnetic energy, initially stored in the circuit inductance, is released as particle energy. Simultanously as the current disrupts, the potential level at a local potential minimum in the plasma decreases. This is expected to cause the disruption by reflection of electrons.

19508 **(TRITA-PFU—83-06) Heating of a permeable rotating plasma by neutral gas interaction.** Lehnert, B. (Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics and Fusion Research). May 1983. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700671.

The heat balance is considered of a rotating plasma which is permeable to neutral gas. The neutral particles which enter the plasma and fill its confinement volume are assumed to have small velocities before interacting with ions and electrons. Plasma-neutral gas interaction then gives rise to a type of frictional heating of the plasma. The conditions are analysed under which this effect becomes the dominant plasma heating mechanism. It is found that thermonuclear ion temperatures become available at rotational velocities of the order of 10^6 m/s. The result rests on two crucial questions. First, it requires the densities of the neutral gas and the plasma to be chosen such as to avoid critical velocity limitation by plasma neutral gas interaction. This question requires further investigation. Second, an excessive power input is required to reach these temperatures, unless the densities of the plasma and the neutral gas are chosen to be small. The power input by far exceeds the thermonuclear production, but the present system may still become useful as a neutron source.

19509 **Ideal and resistive ballooning modes in axisymmetric toroidal plasmas.** Glasser, A.H.; Chance, M.S.; Dewar, R.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 8 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract AC02-76CH03073.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19510 **Systematic optimization of tokamaks to all ideal MHD modes.** Bernard, L.C.; Miller, R.L.; Moore, R.W.; Helton, F.J. (General Atomic Co., San Diego, CA (USA)). pp 11 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19511 **Space potential measurements with particle beam probes.** Hickok, R.L.; Jennings, W.C.; Connor, K.A.; Woo, J.T. (Rensselaer Polytechnic Inst., Troy, NY (USA). Plasma Dynamics Lab.). pp 31 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19512 **Dynamics of alpha particles in tandem mirror plasmas.** Kammash, T.; Galbraith, D.L. (Michigan Univ., Ann Arbor (USA)). pp 37 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19513 **Studies of finite gyro-radius effects in a field reversed mirror configuration.** Miley, G.H.; Gilligan, J.G.; Driemeyer, D.E.; Morse, E.C. (Illinois Univ., Urbana (USA). Fusion Studies Lab.); Condit, W.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 41 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract AC02-76ET52040.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19514 **Charge exchange measurements during neutral beam injection and ICRF heating on PLT.** Medley, S.S.; Bol, K.; Davis, S.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 48 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19515 **Moderate power ICRF heating characteristics for the two-ion regime in PLT.** Hwang, D.; Arunasalam, V.; Bernabei, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 49 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract AC02-76CH03073.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19516 **Finite mean-free-path effects on axial particle transport in mirror devices.** Rognlien, T.D.; Cutler, T.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 50 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract W-7405-ENG-48.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19517 **Influence of microinstabilities on the MHD stability of field reversed pinches.** Hamasaki, S. (Science Applications, Inc., La Jolla, CA (USA)); Krall, N.A.; McBride, J.B. (JAYCOR, Del Mar, CA (USA)). pp 53 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19518 **General theory of kinetic ballooning modes.** Rewoldt, G.; Frieman, E.A.; Tang, W.M.; Glasser, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 56 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract AC02-76CH03073.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19519 **Transport theory of electrostatic microinstabilities.** Sanderson, J.J. (Saint Andrews Univ. (UK)); Gary, S.P. (Los Alamos Scientific Lab., NM (USA)). pp 65 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19520 **Magnetic surfaces, particle orbits and neutral injection in conventional and ultimate torsatrons.** Anderson, D.T.; Derr, J.A.; Kruckewitt, T.; Shohet, J.L. (Wisconsin Univ., Madison (USA)); Rehker, S. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)); Tatoronis, J.A. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences). pp 82 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19521 **Radial transport in the ELMO Bumpy Torus in collisionless regimes.** Jaeger, E.F.; Hedrick, C.L.; Spong, D.A. (Oak Ridge National Lab., TN (USA)). pp 87 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract W-7405-ENG-26.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19522 **Axis encircling ion gyro-instability.** Catto, P.J.; Aamodt, R.E.; Rosenbluth, M. (Science Applications, Inc., Boulder, CO (USA). Lab. for Applied Plasma Studies); Byers, J.A.; Pearlstein, L.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 94 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19523 **Modelling ZT-40 with the G2M diffusion code.** Byrne, R.N. (Science Applications, Inc., La Jolla, CA (USA)); Chu, C.K. (Columbia Univ., New York (USA)). pp 98 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

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REFER ALSO TO CITATION(S) 18471, 18753, 19219, 19383, 19484, 19487, 19488, 19523

19524 **(AD-A—135951/2) Status of light ion inertial fusion research at NRL (Naval Research Laboratory). Memorandum report.** Cooperstein, G.; Ottinger, P.F.; Goldstein, S.A.; Barker, R.J.; Colombant, D.G. (Naval Research Lab., Washington, DC (USA)). 30 Nov 1983. 27p. (NRL-MR—5219). NTIS, PC A03/MF A01.

High-brightness proton beams have recently been extracted from axial pinch-reflex diodes (PRD) mounted on the Gamble II generator. The source power brightness that was measured exceeded 10 TW/sq cm sq rad. Analysis of a modular Inertial confinement fusion system using such diodes shows that an operational window for transport of light-ion species exists. Multi-terawatt beams can be transported a few meters in channels a few centimeters in diameter. A proof-of-principle experiment for the required final focusing cell has been successfully carried out on Gamble II. A new barrel-shaped equatorial PRD that can be coupled to PBFA II as a single diode has also been operated on Gamble II and has demonstrated 50% ion efficiency with predominantly azimuthally-symmetric charged-particle flow. Preliminary experiments using vacuum inductive storage and plasma opening switches have demonstrated factor-of-three pulse compressions, with corresponding power and voltage multiplications for pulse durations of interest to PBFA II. In other experiments the stopping power of deuterons in hot plasmas was measured. Results show about 40% enhancement in stop-

ping power over that in cold targets when the deuteron beam is focused on the target to about 0.25 MA/sq cm.

19525 **(CONF-810831—108-Draft) Material considerations for the Fusion Engineering Device (FED) pump limiter.** Haines, J.R.; Cramer, B.A.; Davisson, J.P.; Mantz, H.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007600.

From 2. fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

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A mechanical pump limiter is provided in the Fusion Engineering Device (FED) to establish the plasma edge, to exhaust plasma particles, to handle a significant fraction of the plasma heat load, and to protect the first wall from large particle and energy fluxes. Various protective surface materials were evaluated for applicability to the limiter. Bare metal and armor tile design concepts were considered. The protective surface concept selected for the baseline FED limiter consists of graphite tiles brazed to a water cooled copper substrate. Graphite and copper were selected because of their resistance to damage at high heat fluxes, the low atomic number of graphite, and the potential for reliable brazing of copper and graphite.

19526 **(DOE/ER/80101—1) Theoretical research on the evaporation of pellets in tokamak plasmas. Final report, September 1, 1983-February 29, 1984.** Larsen, J.T. (KMS Fusion, Inc., Ann Arbor, MI (USA)). Feb 1984. Contract AC02-83ER80101. 89p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84008225.

The complexity of physics processes occurring during pellet ablation necessitates the simultaneous solution of many partial differential equations, which can only be done numerically. We have constructed a one-dimensional, spherically symmetric computer code to solve the equations of hydrodynamics and heat transport. The nonlinear thermal conductivity is treated with a flux-limited prescription. Recent pellet injection experiments are analyzed numerically and compared with an analytic ablation model. Reasonable agreement is achieved between calculation and model. We find little support for the neutral-gas shielding model, but find the ablation rate is controlled by the saturated heat flux in the outer portions of the ablatant.

19527 **(GA-A—17209) Neutral beam power supply timing interlocks.** Kohli, J.C.; Campbell, G.L.; Haskovec, J.S.; Kamperschroer, J.; Lee, G.; Lee, S.T.; Moore, C.D.; Nerem, A.; Tooker, J.F.; Treglio, J.R. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 5p. (CONF-831203—119). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009037.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This paper describes interlocks and timing for GA Technologies Neutral Beam Power Systems (NBPS). Each NBPS requires timing signals which fire the Filament, Arc, Suppressor, Gas and Modulator/Regulator (M/R). The M/R output accelerates the primary hydrogen beam. Each of these timing signals is interlocked in a similar manner. This paper concentrates on the interlocking of the M/R as a representative example. A figure shows how the M/R timing channel is derived and conditioned by an enable and various interlocks to yield a signal which gates on the M/R.

19528 **(GA-A—17211) Doublet III neutral beam computer system overview and upgrade.** Glad, A.S.; Campbell, C.L.; Garcia, J.R.; Kamperschroer, J.H.; Lertique, L.P.; McColl, D.B.; Tooker, J.F. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 5p. (CONF-831203—125). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009017.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Three neutral beamline injectors each containing two ion sources are currently operational on GA Technologies Doublet III tokamak experiment. A separate computer system is implemented for each beamline and provides acquisition, processing and archiving for all beamline and physics data and provides realtime control and automatic sequencing for all modes of operation. The computer system was developed and implemented from three separate software packages. The first, the data acquisition and processing of beamline physics data was built by the University of California Lawrence Berkeley Laboratories (LBL). The second, the real time control and automatic sequencing is an adapted version of the Doublet III control system. The third system, the archiving of all beamline data was developed from the archiving scheme used on the Doublet III diagnostic system. This paper describes the current configurations of the beamline computer systems and provides an insight into the future enhancements for improving the operational capabilities of the beamlines.

19529 **(GA-A—17213) Doublet III neutral beam multistream command language system.** Campbell, L.; Garcia, J.R. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 4p. (CONF-831203—126). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009022.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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A multi-stream command language system was developed to provide control of the dual source neutral beam injectors on the Doublet III experiment at GA Technologies Inc. The Neutral Beam command language system consists of three parts: compiler, sequencer, and interactive task. The command language, which was derived from the Doublet III tokamak command language, POPS, is compiled, using a recursive descent compiler, into reverse polish notation instructions which then can be executed by the sequencer task. The interactive task accepts operator commands via a keyboard. The interactive task directs the operation of three input streams, creating commands which are then executed by the sequencer. The streams correspond to the two sources within a Doublet III neutral beam, plus an interactive stream. The sequencer multiplexes the execution of instructions from these three streams. The instructions include reads and writes to an operator terminal, arithmetic computations, intrinsic functions such as CAMAC input and output, and logical instructions. The neutral beam command language system was implemented using Modular Computer Systems (ModComp) Pascal and consists of two tasks running on a ModComp Classic IV computer.

19530 **(GA-A—17215) Archiving Doublet III neutral beam data for offline analysis and access.** Lertique, L. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 3p. (CONF-831203—127). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84009021.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The neutral beam injectors at GA Technologies operate with a short time interval between pulses. This is intended to keep the injectors conditioned for optimum efficiency. The time required is affected by, but not restricted to, the time required to acquire diagnostic data. The short interval between pulses restricts any in-depth online analysis of the data acquired. The data is archived to tape and transferred to the computer in the GA Technologies User Service Center for later in-depth offline analysis. The archieved tapes are constructed with the same format as the Doublet III Data Acquisition System archived data tapes. This procedure allows the neutral beam data to be archived on the computer in the Users Service Center with the same processing programs and analyzed with any general analysis programs used on the Doublet III Data Acquisition archived tapes.

19531 **(GA-A—17216) Offline processing of Doublet III data.** Drobnis, D.D.; DeBoo, J.; Dy, B.; Ejima, S.; Stockdale, R. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—120). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009036.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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Two groups of physicists currently share operation of the Doublet III tokamak: one group of GA physicists and one from the Japanese Atomic Energy Research Institute (JAERI). The two groups have differing research objectives and data processing requirements, and normally schedule operation of the tokamak on alternate weeks. The discussion which follows is specifically oriented toward post-shot processing methods developed by the GA group.

19532 **(GA-A—17217) Present status of the Doublet III control, acquisition, and archiving computer system.** Drobnis, D.D.; Shepard, G.W.; Kemper, C. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—122). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009035.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The system has evolved from a pair of disconnected minicomputers into a loosely coupled network of about twenty processors, ranging in power from LSI-11 microprocessors through minicomputers to a DECSystem-10 with dual KL-10 processors. The loose coupling serves to preserve the integrity and real-time performance of the online microcomputers and minicomputers, while providing a unified data structure for users from micro through mainframe. This allows FORTRAN programs to see a common data access method throughout. Considerable upgrades have been made to the system since its inception. In support of the Doublet III Vessel Modification Project (Big Dee), considerable additional enhancements are planned throughout the system of support computers, including those in the User Service Center.

19533 **(GA-A—17218) Crosstalk measurement on the D-III neutral beam power supplies.** Nerem, A.; Bowles, E.E.; Callis, R.W.; Colleraine, A.P.; Cowles, G.D.; Kellman, D.H.; Moore, C.D.; Tooker, J.F. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 6p. (CONF-831203—123). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009038.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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The Doublet III neutral beam plasma heating system comprises three beamlines with a total of six ion sources. Each of these ion sources is energized from a Neutral Beam Power System (NBPS) which is capable of delivering pulses at 80 kV and 100 A with pulse lengths up to 1 second in duration. A 138 kV San Diego Gas & Electric Company line is used as the prime power source for the NBPS. The 138 kV line is stepped down through an 84 MVA (pulse rating) 138 kV-12.47 kV transformer and an 8 MVA (pulse rating) 138 kV-480 V transformer. The 12.47 kV transformer feeds six NBPS high voltage circuits. The 480 V transformer supplies power to the filament, arc, and auxiliary power systems and control consoles in each NBPS. Each of the NBPS may block (controlled interruption of NBPS to protect the ion source) several times during a shot. Voltage variations due to such blocking by one or more systems have been measured on the 12.47 kV distribution bus as part of an effort to reduce system interaction.

19534 **(GA-A—17219) Programmable controller: a versatile tool for neutral beam control.** Campbell, G.L.; Haskovec, J.S.; Moore, C.D. (GA Technologies, Inc., San Diego, CA (USA)). Dec 1983. Contract AT03-76ET51011. 5p. (CONF-831203—121). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84009040.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

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After a brief exposition of typical functions the implication of requirements such as expandability, reliability and versatility on hardware configuration and program structure are explained. Results of analysis and tests of time-critical functions are presented. Finally some aspects of interfaces to different instruments and devices are described.

19535 **(GA-A—17324) Magnetic Fusion Energy Program nuclear data needs. Annual report, October 1, 1982-September 30, 1983.** Cheng, E.T.; Mathews, D.R.; Schultz, K.R. (GA Technologies, Inc., San Diego, CA (USA)). Oct 1983. Contract AT03-76ET51011. 79p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84009383.

The major objectives of the Magnetic Fusion Nuclear Data Needs Activity Coordination Program which began in 1982 are to communicate with the data developers and to make sure that the fusion nuclear data needs are given due consideration. We provided input beginning in 1982 to the Office of Basic Energy Sciences sponsored nuclear data measurement programs. We found that these programs have focused their efforts on the development of measured nuclear data for fusion applications. Major progress has been made in the areas of nuclear and physics data for near-term fusion fuels and fusion neutron related data measurements requested by the Office of Fusion Energy. We reviewed the status of high priority fusion dosimetry and activation cross-section data. Conclusions and recommendations relevant to these areas were made. We initiated the fusion nuclear data library comparison study and presented some preliminary results.

19536 **(GSI—83-2) Studies on the feasibility of heavy ion beams for inertial confinement fusion.** (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). May 1983. 91p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE84750509.

This Annual Report summarizes the scientific results of work carried out in 1982 in the framework of a feasibility study for inertial confinement fusion with heavy ion beams funded by the German Ministry of Research and Technology. The principal aim of this basic research program is the investigation of key problems and the identification of critical issues of the heavy ion ICF concept in the fields of accelerator research, atomic physics, target physics, and reactor design. The research is carried out by about ten working groups at various research centers and universities. One of the highlights in 1982 was a symposium held end of March at GSI which focussed on a critical analysis of the HIBALL accelerator concept. Whereas technical issues and hardware parameters were found feasible the beam dynamics in the storage rings turned out to be beyond the so far believed stability limits. As a consequence a revised accelerator scenario based on a lower charge state and a higher linac current has been investigated during the last year. First considerations were made on an experimental facility necessary for the study of high-intensity beam dynamics and of beam target interaction. Experimental studies of this kind will be of increasing importance for the future of the project.

19537 **(HEDL-SA—2927-FP) Verification of the hydraulic design of the FMIT liquid lithium target.** Miles, R.R.; Annese, C.E.; Ingham, J.G. (Hanford Engineering Development Lab., Richland, WA (USA)). 1983. Contract AC06-76FF02170. 5p. (CONF-831203—106). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. Order Number DE84006064.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A liquid lithium target is being developed to generate a neutron flux for material testing in a fusion-like environment. The target consists of a thin, high speed, curved wall jet of lithium which is formed by an asymmetric nozzle. A prototype target was designed using potential flow analysis and was tested in water. Measurements of jet thickness and velocity in water and thickness in lithium were compared with isothermal design predictions and were shown to match within 1% for thickness and 5% for jet velocity.

19538 **(INIS-mf—8703, pp vp) Time variable processes in discharge plasma.** Kapicka, V.; Kapoun, K.; Ondracek, Z. (Universita J.E. Purkyne, Brno (Czechoslovakia). Prirodovedecka Fakulta). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—PT.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19539 (INIS-mf—8703, pp vp) **Plasma acceleration by means of weak magnetic fields.** Maloch, J.; Sobra, K.; Stanek, Z. (Ceske Vysoke Uceni Technicke, . Prague (Czechoslovakia). Fakulta Elektrotechnicka). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19540 (INIS-mf—8703, pp vp) **Plasma compression in front of coaxial plasma gun.** Kravarik, J.; Kravarikova, V.; Seifert, A.; Vich, J. (Ceske Vysoke Uceni Technicke, Podebrady (Czechoslovakia). Fakulta Elektrotechnicka). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19541 (INIS-mf—8703, pp vp) **Model of high-current relativistic electron beam formation in diode.** Vrba, P. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19542 (INIS-mf—8703, pp vp) **50 GW electron accelerator Rebex 2 for investigation of high-current REB-plasma interaction.** Ullschmied, J.; Clupek, M.; Kovac, I.; Piffl, V.; Ripa, M.; Sunka, P. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19543 (INIS-mf—8703, pp vp) **Energy balance in ohmically heated Tokamak TM-1-MH.** Stoeckel, J.; Koerbel, S.; Kryska, L.; Kopecky, V.; Datlov, J.; Jakubka, K.; Magula, P.; Zacek, F. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu); Pereverzev, G.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Khudoleev, A.V. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). 1981. (In Czech). NTIS (US Sales Only), PC A08/MF A01. (CONF-8108164—Pt.1-Vol.1).

From 7. conference of Czechoslovak physicists; Prague, Czechoslovakia (24 Aug 1981).

19544 **(JAERI-M—82-131) Design of bending magnet of neutral beam injection for JT-60.** Itoh, Takao; Horiike, Hiroshi; Kuriyama, Masaaki; Matsuda, Shinzaburo; Matsuoka, Mamoru; Tanaka, Shigeru. (Japan Atomic Energy Research Inst., Tokyo). Sep 1982. 32p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700655.

A reflecting and diverging magnet has been used to bend residual ion beams and guide them to a beam dump in neutral beam injector for JT-60. The reasons for choosing this type of magnet were; it provides us with an effective differential pumping system, it makes it easy to design the beam dump subject to a permissible heat flux, and it can contain all beam line components in the vacuum tank. However, this magnet has a disadvantage that the ion beams are apt to hit a part of the water jacket which protects the pole piece of the magnet, if beam divergence increases slightly. In the design of the magnet, we have carried out detailed researches on the magnetic field by using a 1/10 model of the magnet and a two dimensional magnet field simulation code. Basic design of the water jacket and beam dump have been made, by using the simulation code of heat input due to incidence of fast ion beams, to confirm the heat load on their surface to be less than a permissible value under every condition. In a present report, the design on the magnet is described in detail. The performance test of this magnet is under way in the prototype neutral beam injector for JT-60 which was completed in November 1981, and no difference has been found so far between design values and the test results.

19545 **(JAERI-M—82-136) In-pile experiment for tritium release from Li_2O under high neutron fluence, (1). Planning and safety assessment of VOM-15H.** Watanabe, Hitoshi; Kurasawa, Toshimasa; Takeshita, Hidefumi. (Japan Atomic Energy Research Inst., Tokyo). Oct 1982. 32p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700656.

Studies of tritium release and recovery from a breeding material are very important items in the development of tritium technology for D-T fusion reactors. However, in most of studies done so far in this area, neutron fluences were relatively low (up to about 1×10^{18} n/cm^2) and only post-irradiation annealing methods were adopted as an experimental technique. Such studies could not give sufficient data to understand tritium release behavior. In the present experiment, in-situ measurements will be made on release rates and released compositions (HTO/HT) of tritium produced in Li_2O pellets as a function of neutron fluence up to 5.5×10^{19} n/cm^2 in terms of effective fluence. After the in-pile test, a post-irradiation experiment will be done to reveal a retained amount of tritium in the pellets. In this report, we present an outline of the experiment and the result of the relevent safety assessment; the former includes test items, irradiation conditions and test methods, the latter the estimation of tritium production rate and tritium leak rate to environment, and some countermeasures for accidents. We also give full details of the irradiation capsule for the present experiment.

19546 **(JAERI-M—82-140) Magnetic shields for JT-60 neutral beam injectors. Design and test results.** Tanaka, Shigeru; Horiike, Hiroshi; Itoh, Takao; Kuriyama, Masaaki; Matsuda, Shinzaburo; Matsuoka, Mamoru; Ohara, Yoshihiro; Shirakata, Hirofumi. (Japan Atomic Energy Research Inst., Tokyo). Oct 1982. 46p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700657.

Magnetic shields for the ion sources and the neutralizers for JT-60 neutral beam injectors were designed and tested. The shield for the ion sources consists of the outer shell made of 15-mm thick mild steel and the inner shell made of 5-mm thick mu-metal. The shield for the neutralizers consists of the outer shell of 24-mm thick mild steel and the inner shell of 5-mm thick mu-metal. The thickness of the shells was determined after the experiment on magnetic saturation of the 1/10 and 1/4 models of the shields. The shield for the ion sources is magnetically connected with that for the neutralizers. Magnetic field distributions along the upper and the lower beam lines of the prototype injector unit of JT-60 were measured when the simulating external field was applied to the unit and the first and the second cancellation coils were operated. It proved from the measurement that the shields for the ion sources and the neutralizers showed satisfactory shielding factors. The field strength perpendicular to the beam axis was 0.5 to 0.6 G in the center of the shield for the ion sources and 0.01 to 0.3 G in the center of the shield for the neutralizers. These values are well below the permissible levels.

19547 **(JAERI-M—82-154) Annual report of the Fusion Research and Development Center for the period of April 1, 1981 to March 31, 1982.** (Japan Atomic Energy Research Inst., Tokyo). Nov 1982. 211p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE84700658.

Research and development activities of the Fusion Research and Development Center (Division of Thermonuclear Fusion Research and Division of Large Tokamak Development) from April 1981 to March 1982 are described. Emphasis in the JFT-2 and Doublet III Tokamak programs was placed on high-power heating experiments. JFT-2M, which is to replace JFT-2, is in fabrication and will be operational in early 1983. Construction of JT-60 progressed as planned with its completion targeted in March 1985. In fusion technology programs development of the prototype NBI unit and klystrons for JT-60 made satisfactory progress; particularly rewarding was the demonstration of full capability of the NBI prototype unit in March 1982. The Japanese coil for the IEA Large Coil Task was completed and passed the cooldown test in the domestic test facility. Activities in the design of the near-term FER and INTOR and the power reactor were continued.

19548 (JAERI-M—82-171) Japanese contributions to IAEA INTOR workshop, phase IIA. Chapter 4: plasma confinement and control. Miyamoto, Kenro; Sugihara, Masayoshi; Ueda, Kojyu. (Japan Atomic Energy Research Inst., Tokyo). Nov 1982. 49p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700659.

This report corresponds to Chapter IV of Japanese contribution report to IAEA INTOR workshop, Phase IIA. Studies are centered on confinement performance of INTOR core plasmas, losses induced by toroidal field ripples and discharge controls indispensable to long burn.

19549 (JAERI-M—82-172) Japanese contributions to IAEA INTOR workshop, phase IIA. Chapter 5: RF heating and current drive. Miyamoto, Kenro; Sugihara, Masayoshi; Kimura, Haruyuki. (Japan Atomic Energy Research Inst., Tokyo). Nov 1982. 101p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE84700660.

This report corresponds to Chapter V of Japanese contribution report to IAEA INTOR workshop, Phase IIA. Physics studies for radio frequency heating are concentrated on heating to ignition by means of ion cyclotron and lower hybrid ranges of frequencies, and discharge start-up assist and current drive by lower hybrid range. Their system design studies are also performed.

19550 (JAERI-M—82-173) Japanese contributions to IAEA INTOR workshop, phase IIA. Chapter 6: impurity control physics. Fujisawa, Noboru; Sugihara, Masayoshi; Shimada, Michiya; Saito, Seiji. (Japan Atomic Energy Research Inst., Tokyo). Nov 1982. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700661.

This report corresponds to Chapter VI of Japanese contribution report to IAEA INTOR workshop, Phase IIA. Special emphasis is placed on pumped limiter analysis for comparative studies between limiter and divertor concepts. Pumping characteristics of divertor/limiter and radiation cooling of diverted plasmas by impurities are also intensively studied.

19551 (JAERI-M—82-186) Characteristics of solid oxide electrolysis cell for decomposition of tritiated water. Konishi, Satoshi; Ohno, Hideo; Yoshida, Hiroshi; Naruse, Yuji. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 26p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700662.

The characteristics of the solid oxide electrolysis cell have been studied for the purpose of the application to the decomposition process of tritiated water in the fusion fuel cycle. Characteristics of the cell were expressed using the Nernst's equation. Conversion ratio of water to hydrogen depends on the open circuit (Ir-free) voltage and little depends on the temperature. Experiments on the electrolysis of water in Ar carrier were carried out using calcia stabilized zirconia (CSZ) and yttria stabilized zirconia (YSZ) in the temperature range of 500°C to 900°C. The characteristics well agreed with the theory. Ionic conductivity of the cells were measured and proved to be written in Arrhenius forms. The upper limit of current density across the cell can be inferred from the results as a function of the operation temperature. Designs of the electrolyzer and application to the tritium systems for fusion reactor are also discussed. Tritium permeation from the electrolyzer is expected to be very small irrespective of the operation temperature. Tritium systems with recovery process from tritiated water will be simplified by use of the electrolyzer.

19552 (JAERI-M—82-205) Mechanical strength evaluation of the welded bellows for the ports of the JT-60 vacuum vessel. Takatsu, Hideyuki; Yamamoto, Masahiro; Shimizu, Masatsugu; Suzuki, Kazuo; Sonobe, Tadashi; Hayashi, Yuzo; Mizuno, Gen-ichiro. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 46p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700663.

Mechanical strength of the welded bellows applied to the ports of the JT-60 vacuum vessel was evaluated, laying the emphasis on the fatigue strength under the torsional load. The welded bellows were designed to be loaded with the forced deflection due to the relative displacement between the vacuum vessel and the external fixed point, the atmospheric pressure and the forced torsional angle due to the electromagnetic force. Stresses caused by the former two were estimated following the formulae proposed by the Kellogg Company. On the other hand, the formulae were established to estimate the stress caused by the last, after examining experimentally the behavior of the welded bellows under the torsional load; one is the shearing stress evaluation formula in the case of non-buckling and the other is the axial bending stress evaluation formula in the case of buckling. Design fatigue curve of the welded bellows was established by comparing the nominal stress with the number to failure obtained in the fatigue tests using the welded bellows made from the same material as the actual ones. And the number to failure was predicted by applying the nominal stress obtained by the stress calculation formulae to the design fatigue curve. The present mechanical strength evaluation method was applied to the three kinds of the welded bellows to be used in the ports of the JT-60 vacuum vessel and it was confirmed that they have sufficient strength in the range of the design load conditions.

19553 (JAERI-M—82-209) Multi-channel optical beam monitor for the prototype neutral beam injector unit for JT-60. Kawai, Mikito; Akiba, Masato. (Japan Atomic Energy Research Inst., Tokyo). Dec 1982. 21p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700664.

A multi-channel optical beam monitor is equipped in the prototype neutral beam injectior unit for jt-60 to measure the beam profile of intense neutral beams. Optical filters are used to eliminate background lights from hot tungsten filamanets in the ion source. The performance test shows that the beam axis is determined within the accuracy of 0.06° for the horizontal direction, and thus the applicability of the optical beam monitor in the JT-60 neutral beam injector.

19554 (JAERI-M—82-213) Vertical position control of the elongated INTOR plasma. Ueda, Kojyu; Nishio, Satoshi; Fujisawa, Noboru; Sugihara, Masayoshi; Saito, Seiji; Miyamoto, Kenro. (Japan Atomic Energy Research Inst., Tokyo). Jan 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84700665.

A newly devised rectangular shell, which has the sufficient shell effect for the stabilization of the fast mode, is presented, along with the studies of various kinds of shell-structures described on this paper. It can be expected that the rectangular shells have negligibly small effect on the breeding ratio by locating them separately on both of the front and rear surfaces of blanket. Some properties with the modelled feedback control system are elucidated under a disturbance field, B sub(d) = B sub(infinity).[1-exp(-t/tau sub(d))] (B sub(infinity): field strength at t = infinity, tau sub(d): time constant). They are studied for two kinds of decay indices, that is, -1.0 for the pump limiter and -1.3 for the divertor. Conclusively, the control system is found to have good characteristics. The PID controller seems to provide the stable control of vertical position better than the PI controller. The maximum of vertical displacement, Z sub(p)sup(max) under the disturbance field, B sub(d), are in proportion to B sub(infinity). The power required for its stabilization, P, are also in proportion to B sub(infinity)sup(2), and then to (Z sub(P)sup(MAX))sup(2), too. Therefore, some common basis for B sub(infinity) or Z sub(P)sup(MAX) is required for its estimation. Moreover, the power is found to be independent of selection of the PI or PID controller, and to have approximately the same relation with Z sub(P)sup(MAX). The difference of P between -1.0 and -1.3 in the decay index is very large when Z sub(P)sup(MAX) is more than -1.0 cm. For example, in the vicinity of Z sub(P)sup(MAX) = 1.0 cm, the power in the case of n = -1.0 is about one half of that in the case of n = -1.3. But it decreases abruptly when Z sub(P)sup(MAX) is less than 0.5 cm.

19555 (JAERI-M—82-217) Poloidal field distribution studies in tokamak reactor. Ueda, Kojyu; Nishio, Satoshi; Fujisawa, Noboru; Sugihara, Masayoshi; Saito, Seiji. (Japan Atomic Energy Research Inst., Tokyo). Jan 1983. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE84700666.

On the design studies with the INTOR plasma equilibrium and poloidal field coil configuration (PFCC) from the Phase I to the Phase II A have been obtained the following main results. Three optimized PFCCs have been obtained: the INTOR-J "Universal" with the optimized PFCC for the divertor configuration, the optimized PFCC for the pump limiter, and the INTOR "Universal" with the PFCC defined as the INTOR reference. These PFCCs satisfy with the requirements for the porthole size for the remote assembly and maintenance of the device, and the maximum flux swing and current densities of the solenoidal coils. The INTOR-J "Universal" will be almost the same as the INTOR "Universal" in the reactor size. But the optimized PFCC for the pump limiter will be a little larger than the above two configuration because of being in need of slightly larger radii on the two large coils if the plasma with 1.5 in elongation is unconditionally necessary. The total sum of absolute currents with PFCC, which is used as a parameter for its figure of merit, is found to be given in a range of 80 -- 90 MAT at high beta for the divertor configuration for both of the INTOR-J "Universal" and the INTOR "Universal". The optimized PFCC for pump limiter has 70 -- 80 MAT in its range. The INTOR-J "Universal" and the INTOR "Universal" for the pump limiter will have its larger sum than one optimized for pump limiter by several MAT. The "EF only" method, where the flux, psi sub(P), necessary for maintaining the plasma current on high beta is provided only by EF coils, seems to give the total sum a little less than the "EF + OH" method using EF and OH coils for psi sub(P).

19556 **(JAERI-M—83-005) Japanese contributions to the Japan-US workshop on blanket design/technology. Exchange B-39 in the Japan-US fusion cooperation program, November 10-11, 1982.** Tone, Tatsuzo; Seki, Yasushi; Minato, Akio; Kobayashi, Takeshi; Mori, Seiji; Kawasaki, Hiromitsu; Sumita, Kenji. (Japan Atomic Energy Research Inst., Tokyo). Feb 1983. 139p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE84700667.

This report describes Japanese papers presented at the Japan-US Workshop on Blanket Design/Technology which was held at Argonne National Laboratory, November 10 - 11, 1982. Overview of Fusion Experimental Reactor (FER), JAERI's activities related to first wall/blanket/shield, summary of FER blanket and its technology development issues and summary of activities at universities on fusion reactor blanket engineering are covered.

19557 **(JAERI-M—83-008) Observation of very dense and cold divertor plasma in beam heated Doublet III tokamak with single-null poloidal divertor.** Sengoku, Seio; Shimada, Michiya; Kasai, Masao. (Japan Atomic Energy Research Inst., Tokyo). Feb 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700668.

A very dense and cold divertor plasma associated with strong remote radiative cooling has been observed by a Langmuir probe array installed in the Doublet III divertor plates with beam-heated diverted discharges (injected power of up to 1.2 MW). The divertor plasma becomes denser and colder as the line-averaged electron density of the main plasma n-bar sub(e) is increased. The maximum electron density obtained is n sub(ed) = 2.8 x 10^{14} cm^{-3} at the divertor plate when n-bar sub(e) = 3.4 x 10^{13} cm^{-3}. The electron temperature at the divertor plate is T sub(ed) = 3.5 eV at the same condition. This result indicates that dense and cold plasma obtained in a single-null poloidal divertor provides the solution for the wall erosion problem.

19558 **(LA—9908) Electrodynamic interpretation of virtual-cathode oscillations.** Kadish, A. (Los Alamos National Lab., NM (USA)). Jan 1984. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008001.

Virtual-cathode oscillations and particle bunching are proved to be electrodynamic shock-induced phenomena when magnetic-field and thermal effects are small compared to those due to plasma energy and electric fields. This result is derived for general configurations. The complete solution of one-dimensional problems is reduced to quadratures.

19559 **(LA-UR—84-602) Translation of field-reversed configurations in the FRX C/T experiment.** Rej, D.J.; Armstrong, W.T.; Chrien, R.E.; Klingner, P.L.; Linford, R.K.; McKenna, K.F.; Milroy, R.D.; Sherwood, E.G.; Siemon, R.E.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-840255—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007489.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

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One of the unique features inherent to compact toroids is the potential ability to translate the plasma along its geometric axis. CT translation has proven useful in reactor design studies, and has been the focus of several experimental investigations. In this paper, we report on the initial results from translation experiments performed with the field-reversed configuration (FRC) plasmas generated in the FRX-C/T device.

19560 **(LA-UR—84-603) Coaxial slow source: a quasi-static FRC formation concept.** McKenna, K.F.; Gribble, R.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-840255—3). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007476.

From 6. US-Japan symposium on compact toroid research; Princeton, NJ, USA (20 Feb 1984).

The electromagnetics of one of several techniques for generating FRCs in a coaxial configuration has been presented. It has been shown that the discussed design satisfies all the electromagnetic requirements for a slow source. The next major issue is the investigation of the plasma physics which will ultimately determine the viability of this concept.

19561 **(LA-UR—84-606) Heavy ion fusion physics issues.** Bangerter, R.O. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 13p. (CONF-840142—4). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007483.

From International symposium on heavy ion accelerators and their applications to inertial fusion; Tokyo, Japan (23 Jan 1984).

A simple systems model has been used to determine the sensitivity of the cost of electricity and the total cost of a power plant to the various uncertainties expressed in the following six issues. (1) can, at reasonable cost, an accelerator be built that puts more than 1 MJ of energy into a small 6-D phase space volume. (2) Can the beam be focused over a distance of several meters onto a small target in a reaction chamber. (3) Do present calculations adequately describe ion energy deposition. (4) Do current numerical simulations adequately describe the hydrodynamic and thermonuclear behavior of targets. (5) Can targets be cheaply mass produced. (6) Can an economical, tritium-breeding reactor be built.

19562 **(LA-UR—84-714) Role of magnetic reconnection phenomena in the reversed-field pinch.** Baker, D.A. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 35p. (CONF-8310229—10). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84007470.

From Chapman conference on magnetic reconnection; Los Alamos, NM, USA (3 Oct 1983).

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The reversed-field pinch (RFP), an axisymmetric toroidal magnetic confinement experiment, has physics rich in the area commonly called field line reconnection or merging. This paper reviews the topics where reconnection plays a vital role: (a) RFP formation and the phenomenon of self-reversal, (b) RFP sustainment in which the RFP configuration has been shown to be capable of maintaining itself for times much longer than earlier predictions from classical resistive MHD theory, (c) steady state current drive in which dynamo action and associated reconnection processes give rise to the possibility of sustaining the configuration indefinitely by means of low frequency ac modulation of the toroidal and poloidal magnetic fields, (d) the effects of reconnection on the formation and evolution of the magnetic surfaces which are intimately related to the plasma containment properties. It appears that all phases of the RFP operation are intimately related to the reconnection and

field regeneration processes similar to those encountered in space and astrophysics.

19563 **(MPQ—76) Measurements of ablation depth in laser-produced plasmas by x-ray spectroscopy.** Kishimoto, T. (Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)). Jul 1983. 84p. (In German). Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.).

We report on X-ray spectroscopic measurements of the ablation depth by using layered targets. The Plasma was produced by the iodine laser Asterix III (lambda = 1.3 μm, 2 x 10^{14} W/cm^2 in 300 ps pulses). Layered targets of different compositional (Al on SiO_2, SiO_2 on Al, plastic on Al) were used. The line emission in the range of 6-8 A was measured absolutely by a flat Braggcrystal (EDDT) spectrometer and photographic film. The characteristic ablationdepth was (4-5) x 10^{-5} g/cm^2. The absolutely measured line spectrum is consistent with an ion density approx.= 10^{20} cm^{-3} and an electron temperature 500 to 850 eV. The experimental data are compared within hydrodynamic calculations and indicate electron heat flux inhibition (f = 2% to 3%).

19564 **(NRL-MR—5237) Novel x-ray backlighting method for Rayleigh-Taylor instability measurements on ablatively driven targets.** Grun, J.; Kacenjar, S. (Naval Research Lab., Washington, DC (USA)). 17 Feb 1984. Contract AI08-79DP40092. 17p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007762.

We describe a face-on x-ray backlighting method that does not require a dedicated laser beam and a separate x-ray source. This method is used to measure the lateral mass transfer characteristic of the Rayleigh-Taylor instability in ablatively accelerated, laser driven targets.

19565 **(ORNL/Sub—79-33200/15) Development program for a 200kW, CW gyrotron. Quarterly report No. 15, January-March 1983.** Tancredi, J.J.; DeHope, W.J.; Ferguson, P.E.; Hart, S.L.; Matranga, V.A.; Sandoval, J.J.; Schmitt, M.J. (Hughes Aircraft Co., Torrance, CA (USA). Electron Dynamics Div.). 1983. Contract W-7405-ENG-26. 40p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84007945.

The objective of this program is the design and development of a millimeter-wave device to produce 200 kW of continuous wave power at 60 GHz. The device, a gyrotron oscillator, will be compatible with power delivery to an electron cyclotron heated plasma. Smooth control of rf power over a 17 dB range is required, and the device should be capable of operation into a severely time-varying load mismatch. Long-pulse testing continued on gyrotrons S/N 1A and 2A during this report period. While testing S/N 1A at 181 kW and 60 ms pulse width, a window failure occurred which was attributed to a faulty arc detector. Long-pulse testing up to 207 kW was achieved, however, on S/N 2A at 100 ms pulse width. This was a major program milestone.

19566 **(PB—84-139955) Heavy ion inertial fusion: an overview.** Lawson, J.D. (Rutherford Appleton Lab., Chilton (UK)). 1984. 22p. (RL—83-083). NTIS, PC AE03/MF E03.

Energetic heavy ions represent an alternative to laser light and light ions as 'drivers' for supplying energy for inertial confinement fusion. To induce ignition of targets containing thermonuclear fuel, an energy of several megajoules has to be focused on to a target with radium a few millimetres in a time of some tens of nanoseconds. Serious study of the use of heavy ions drivers for producing useful power in this way has been underway for seven years, though funding has been at a low level. In this paper the requirements for targets, accelerator, and reactor vessel for containing the thermonuclear explosion are surveyed, and some of the problems to be solved before the construction of a power station can realistically be contemplated are discussed. (Copyright (c) Science and Engineering Research Council 1983.)

19567 **(UCRL—88925) Longitudinal and transverse coupling in accelerator beam plasmas.** Krafft, G.; Mark, J.W.K.; Smith, L.; Wang, T.F. (Lawrence Livermore National Lab., CA (USA); Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 9p. (CONF-810620—23). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007786.

From 4. international topical conference on high-power electron and ion-beam research and technology; Palaiseau, France (29 Jun 1981).

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Based on a warm beam model, a full 3-D electrostatic linearized stability analysis is carried out within the context of Vlasov-Maxwell equations. The coupling of longitudinal and transverse motions is included as well as arbitrary wall impedance. Numerical results show that the warm beam is rather stable for zero wall impedance. A known artifact of the model introduces the only non-resistive instability due to two rotating streams. This type of instability stabilizes when rotation frequency vanishes. For general wall impedance, Landau damping quenches instabilities provided there is sufficient longitudinal energy spread.

19568 **(ZOS—82-6) Laser fusion target illumination optimization with consideration of the beam divergence.** Grzanna, J.; Schoennagel, H. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Optik und Spektroskopie). Sep 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE84700672.

Using a focusing system with a great focal length it is demonstrated that the radiation divergence considerably influences the illumination optimization. If the channel beam is composed of several single beams, there are two optimum illumination variants: the channel beam tangent and the single beam tangent illumination. Further, it is shown that the illumination channel distribution function can vary in the central region without any effect on the illumination uniformity. The deviation at the periphery is more critical. The most homogeneous illumination and favourable energy transfer would be obtained by low radiation divergence and optimum lateral and axial defocusing of the single beam imaging a suitable near-field intensity pattern on the target surface. It is emphasized that the estimation was made without considering the plasma parameters and the dynamic variation in time.

19569 **Reflection and scattering from CO_2-laser-produced plasmas.** Hubbard, M. Oxford, England; Oxford University (1981). 172p. British Library, Boston Spa, Wetherby, West Yorks. No. D45037/83.

An experimental study of the interaction between 10.59 μm CO_2-laser radiation and the plasma produced by that radiation on plane, massive targets in a vacuum, is described. The spatial, temporal and spectral characteristics of the scattered light were investigated. The irradiation conditions were investigated by analysis of the far field energy distribution. High absorption of the incident radiation was inferred from the low reflectivity level. The total reflection was measured. A simple model was developed to enable the classical absorption contribution to the total absorption to be estimated, and results indicated that inverse bremsstrahlung absorption would be an important process. The contribution of anomalous absorption and scattering processes was estimated. Predicted cold electron temperatures and density scale lengths from the model, agreed well with those determined experimentally. The spectral composition of the backscattered radiation in the region of the fundamental was investigated, and measured spectra were successfully interpreted by considering the stimulated Brillouin scattering process, and the Doppler effect of the expanding plasma corona. In particular the dependence of the parametric growth rate on electron density was investigated by numerical solution of the ion acoustic wave dispersion relation. The angular distribution of the backscattered radiation was determined. The effect of wave refraction in the underdense plasma was investigated using an X-ray tracing routine.

19570 **High power neutral beam experiments on ISX-B.** Swain, D.W.; Bates, S.C.; Bush, C.E. (Oak Ridge National Lab., TN (USA)). pp 44 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—). Contract W-7405-ENG-26.

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19571 **Fusion neutron production during deuterium neutral beam injection into PLT.** Colestock, P.L.; Davis, S.; Efthimion, P. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 45 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19572 **Flux and energy of deuterium incident on a limiter-like probe in PLT.** McCracken, G.M.; Cohen, S.A.; Dylla, H.F.; Magee, C.W.; Picraux, S.T.; Rossnagel, S.M.; Wampler, W.R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 89 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19573 **Initial operation of PDX.** Meade, D.; Arunasalam, W.; Barnes, C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). pp 91 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

19574 **Magnetic field generation in imploding plasmas due to Nernst refrigeration.** Brownell, J.H. (Los Alamos Scientific Lab., NM (USA)). pp 96 of 9th European conference on controlled fusion and plasma physics, Oxford, 17-21 September 1979. Contributed papers. Culham, England; UKAEA Culham Laboratory (1979). (CONF-790912—).

From 9. European conference on controlled fusion and plasma physics; Oxford, UK (17 Sep 1979).

99 GENERAL AND MISCELLANEOUS

9901 Management

REFER ALSO TO CITATION(S) 18462

19575 **(ANL/TM—414) Guide to reporting time in the financial information system at ANL.** Bretscher, M.E.; Butler, J.L.; Skelley, L.J. (Argonne National Lab., IL (USA)). Mar 1984. Contract W-31-109-ENG-38. 58p. NTIS, PC A04/MF A01; GPO Dep. Order Number DE84009356.

Operation of a new system is described with which the full cost recovery service centers of the Laboratory report employee time, whether the time is charged to another organization or to an internal function. Most service centers of the Laboratory currently report employee time to the Financial Information System (FIS) via time cards or timesheets, which are routed to the Data Entry group of the Administrative Data Processing Operations, Building 201, where the time records are keyed. With this new system, the service center assumes primary reponsibility for the keying and management of time charges. The system provides these benefits to the service center: a choice of processing period and month-end boundary, printed timesheets with history of charges by employee, prevalidation of charges, thus fewer rejected charges, and computer-readable file of current and prior charges for analysis. The Controller's Office plans to implement the time reporting system on a division-by-division basis until most service centers assume responsibility for their time charges.

19576 **(DOE/EI/11896—T1) Accounting and auditing support services for the Department of Energy, Energy Information Administration, Financial Reporting System, Form EIA-28. Final report.** (Watson, Rice and Co., Washington, DC (USA)). 30 Jun 1983. Contract AC01-82EI11896. 14p. NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007940.

Conceptual audits were performed for the 26 Financial Reporting System (FRS) companies. These included both analytic and mechanical security checks to evaluate the reliability of the information collected on the Form EIA-28.

19577 **(DOE/MA—0106/1) Report to Congress on the Small Business Program of the Department of Energy.** (USDOE Office of the Secretary, Washington, DC). Jan 1984. 44p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009107.

On January 5, 1983, the Department of Energy accepted a 10% increase in its Small and Disadvantaged Business goal. The Office of Small and Disadvantaged Business Utilization was designated to implement and coordinate departmental plans and actions to carry out the President's minority business contracting initiatives. Annual minority business enterprise development plans must be developed. The total procurements awarded to all small businesses in FY 1983 was 22.1% ($2.2 billion).

19578 **(DOE/TIC—84/4/EM) Energy meetings.** Goodman, P. (ed.). (USDOE Technical Information Center, Oak Ridge, TN). Apr 1984. 51p. (PB—84-901504). NTIS - $5.00.

Energy Meetings is a monthly publication listing conferences, symposia, workshops, congresses, and other formal meetings pertaining to DOE's programmatic interests. Information about meetings is presented in two ways: Part I is a chronological list, and Part II is a list arranged by subject category. All meetings announced are also included in the information data base of the Department of Energy's Technical Information Center. Energy Meetings is available to the public on a subscription basis as PB84-901500 from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent. A single issue is $5.00 (domestic) and $10.00 (outside the North American continent).

19579 **(KFA-ASS—0372) Activity report 1982 of the Department Safety and Radiation Protection.** Hille, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Sicherheit und Strahlenschutz). May 1983. 209p. (In German). Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.).

This report gives a survey on ASS activities during the previous year. After the structure of ASS had basically been organized, 1982 was characterized by working out detailed questions of organization. These included the description of the ASS tasks within the KFA safety organization and the appointment of the department director as the Safety Inspector (SSB). The SBV's field of responsibility refers primarily to intervene in cases of unexpected events; also he is in charge of the KFA emergency organization in events of crisis.

19580 **(LA—10027-MS) Annotated bibliography on decision analysis with applications to project management.** Booker, J.M.; Bryson, M.C. (Los Alamos National Lab., NM (USA)). Feb 1984. Contract W-7405-ENG-36. 50p. NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008282.

The results of an extensive literature survey on decision analysis, with specific application to problems in research and development project management, are summarized in bibliographic form. Approximately 215 references are organized by subject

matter and also summarized and annotated (several lines per reference) in a separate listing.

19581 **(NP—4900854) Preserve the sense of earth from space.** (National Commission on Libraries and Information Science, Washington, DC (USA)). Dec 1983. 84p. NTIS, PC A05/MF A01. Order Number DE84900854.

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This report presents the results of a three-month effort by the Panel on the Information Policy Implications of Archiving Satellite Data, which was convened by the National Commission on Libraries and Information Science in September 1983. The Panel held two meetings, the initial session on September 12, 1983 and the concluding one on November 28, 1983. On the basis of its consideration of the archiving requirements that should be imposed in the event of a transfer of the US land remote-sensing satellite systems to the private sector, the Panel conclusions are presented. It should be emphasized that the Panel was not asked to judge the desirability of the proposed transfer but, rather, to recommend the archiving requirements that should be included in the government's request for proposals (RFP) from potential bidders.

19582 **(NSF—80-312) Federal support to universities, colleges, and selected nonprofit institutions, fiscal year 1978. Final report.** (National Science Foundation, Washington, DC (USA)). May 1980. 162p. National Science Foundation, Washington, DC 20550.

Report to the President and Congress.

This report presents data collected in the National Science Foundation's (NSF) Survey of Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1978, covering the period October 1, 1977 through September 30, 1978. The figures shown in these tables represent all obligations to institutions of higher education in the United States. The 14 Federal agencies represented accounted for an estimated 95 percent of total obligations to universities and colleges and over 99 percent of all funding for scientific and engineering (S/E) research and development at such institutions.

19583 **(NUREG/BR—0059-Rev.1) Small Business Innovation Research Program. Program solicitation FY 1984.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Contracts). 1984. 41p. NTIS, PC A03/MF A01 - GPO. Order Number DE84900831.

The Nuclear Regulatory Commission (NRC) invites science-based and high-technology small business firms to submit research proposals under this program solicitation entitled Small Business Innovation Research (SBIR). Firms with strong research capabilities in science or engineering in any of the following topic areas are encouraged to participate. NRC will support high-quality research proposals on important scientific or engineering problems and opportunities that could lead to significant advancement in the safety of nuclear operations or nuclear power plants. Objectives of the solicitation include stimulating technological innovation in the private sector, strengthening the role of small business in meeting Federal research and development needs, increasing the commercial application of NRC-supported research results, and improving the return on investment from Federally funded research for economic and social benefits to the Nation.

19584 **(NUREG/CR—3601) Management and organizational assessments: a review of selected organizations.** Nadel, M.V.; Kerwin, C.M. (Battelle Human Affairs Research Centers, Washington, DC (USA)). Feb 1984. Contract AC06-76RL01830. 41p. (PNL—4813; BHARC—400/83/016). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008281.

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This report is part of a larger project designed to assist the NRC in its responsibilities for assessing the management and organization of utilities applying for an operating license for a nuclear power plant. This report reviews the processes and criteria used by other organizations that conduct management and organization audits and evaluations. It was undertaken in order to provide data and a basis for future analysis by taking a comparative perspective. When considering changes in criteria and procedures as the NRC is doing, a standard benchmark is the performance of other organizations that are similarly situated. It was our goal to directly inform the NRC about the activities of other organizations so that a reconsideration of NRC activities could benefit from the perspective of organizations with a longer, broader, and different experience than the NRC has in the management and organization area. Data collected for this report has provided useful information in designing organization and administration guidelines and assessment procedures for consideration by the NRC.

19585 **(SAND—83-1684-Vol.1) Assessment of educational research capabilities at selected minority institutions.** Jones, W.J. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jul 1983. Contract AM01-76EI02295. 87p. NTIS, PC A05/MF A01; GPO Dep. Order Number DE84002130.

A university, or consortia, to be engaged in DOE R and D programs, must be a source of high quality science, be able to mount multidisciplinary efforts, be dedicated to the agency mission, and be able to bring together unique outside resources if not available elsewhere. The DOE should establish a process through which the minority institutions can more fully participate in the funded research process and not be subjected to criticism which has any reasonable chance of being valid. The DOE should support efforts to establish opportunity for access to and participation in all of the DOE programs by minority colleges and universities so that they can become resources that can contribute to the solution of the nation's energy problems through: involvement in research and development programs of the DOE, and eventually in those of other agencies and industry; education and training of the quantities of personnel needed in energy, energy technology, energy-related issues and disciplines; planning, decision and preparation of quality interdisciplinary curricula; acquisition of the understanding of energy, energy technology, and energy-related issues and policy necessary for technology and information transfer to the local community, industry, academia, and governments; and support of exploratory research in unique projects and new ideas prior to the researcher's obtaining longer-term support elsewhere.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 18109, 19232, 19269, 19480

19586 **(AD-A—136372/0) Analysis of an error masking scheme for parallel computations. Technical report.** Meyer, G.G.L.; Weinert, H.L. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Electrical Engineering and Computer Science). Dec 1983. 24p. NTIS, PC A02/MF A01.

The authors determine the conditions under which an error masking scheme based on strict redundancy can be used to increase our confidence in the results of parallel computations. This study shows that the issues of speed and reliability of parallel processors are interdependent and must be considered jointly at the design stage.

19587 **(AD-A—136555/0) Cray-class multiprocessor simulator. Technical report.** Summers, P.M.; Orbits, D.A. (Michigan Univ., Ann Arbor (USA). Supercomputer Algorithm Research Lab.). 1 Sep 1983. 130p. NTIS, PC A07/MF A01.

A logical-timing instruction-level simulator is described for a hypothetical multiprocessor consisting of CRAY-1's connected to a common memory. It is useful for gaining insight into the design of multiprocessor algorithms and for developing high performance algorithms for CRAY processors with instruction sets similar to the CRAY-1.

19588 **(AD-A—136570/9) Summary of work done on grant AFOSR-82-0078. Interim report 1 Jan 82-15 Mar 83.** O'Leary, D.P.; Stewart, G.W. (Maryland Univ., College Park (USA). Dept. of Computer Science). 15 Mar 1983. 7p. NTIS, PC A02/MF A01.

This is a summary of work accomplished under the grant. The purpose of this effort is to develop realistic algorithms for

matrix computations on parallel computers. The research is proceeding in three stages. First, decide on a suitable way of connecting and synchronizing processors for parallel matrix computations. Second, design and build a communications system to realize this network on the ZMOB. Third, code matrix algorithms for the system, and experiment with them. In addition, the investigators must install and test the floating-point processors which were requested as part of the initial grant period.

19589 **(ANL/TM—413) Guide to computer protection at ANL.** Kolsto, E.; Beck, C.; Royston, R. (Argonne National Lab., IL (USA)). Feb 1984. Contract W-31-109-ENG-38. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. Order Number DE84009357.

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The Computing Services Division has prepared Guide to Computer Protection at ANL to help Argonne computer users and managers comply with the Laboratory policy on computer protection. This Guide deals with the requirements of DOE Order 1360.2, Computer Security Program for Unclassified Computer Systems. All computer users and managers responsible either for data and applications which fall within category two or for computers which process category two type sensitive data or applications should read the main text of this document. Argonne computers are increasingly used to store, manipulate, and disseminate unclasssified sensitive information. Argonne National Laboratory requires that all persons who store unclassified sensitive information in a computer protect the use and dissemination of that information. All persons who have access to this information also have responsibilities to protect it.

19590 **(EIR—490) Semi-Markov process. Generalizations and calculation rules for application in the analysis of systems.** Hirschmann, H. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jun 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE84750496.

The consequences of the basic assumptions of the semi-Markov process as defined from a homogeneous renewal process with a stationary Markov condition are reviewed. The notion of the semi-Markov process is generalized by its redefinition from a nonstationary Markov renewal process. For both the nongeneralized and the generalized case a representation of the first order conditional state probabilities is derived in terms of the transition probabilities of the Markov renewal process. Some useful calculation rules (regeneration rules) are derived for the conditional state probabilities of the semi-Markov process. Compared to the semi-Markov process in its usual definition the generalized process allows the analysis of a larger class of systems. For instance systems with arbitrarily distributed life times of their components can be described. There is also a chance to describe systems which are modified during time by forces or manipulations from outside.

19591 **(GSI—83-4-Vol.2) Experiment data acquisition and analysis system. Vol. 2.** Busch, F.; Croome, D.; Goeringer, H.; Hartmann, V.; Lowsky, J.; Marinescu, D.; Richter, M.; Winkelmann, K. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1983. 312p. NTIS (US Sales Only), PC A14/MF A01. Order Number DE84750735.

The commands of the programming language developed for the data acquisition and analysis system of GSI are listed in this volume.

19592 **(KFK—3558) Picture editor E82.** Enderle, G.; Bechler, K.H.; Fischer, C.; Marek, U.; Olbrich, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jul 1983. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE84750873.

The program E82 is an interactive picture-editor for creating, manipulating and displaying pictures. It is based on the standardized Graphical Kernel System and is coded in the programming language FORTRAN 77. Besides general picture editing capabilities, the editor E82 contains a presentation graphics module for generating charts from given data values. The user communication is controlled by a command processor that handles commands, macros and graphical interactions. This report contains the user guide for the editor E82.

19593 **(LA-UR—84-429) Solitons in synthetic and biological polymers.** Bishop, A.R. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 22p. (CONF-830697—4). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007505.

From International conference on nonlinear electrodynamics in biological systems; Loma Linda, CA, USA (5 Jun 1983).

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Solid state and statistical physics applications of soliton mathematics continue to expand rapidly. The present report describes connections between solid state (e.g. synthetic polymer) and biophysics, with strong nonlinearity playing the unifying role. Striking parallels examined include: analytical (as in the case of self-trapping mechanisms); numerical techniques; experimental implications, applications, and techniques. Conventional solid state probes are at last being devoted to biopolymers but their complexity is demanding new extremes and techniques.

19594 **(LA-UR—84-650) Attacks on computers: Congressional hearings and pending legislation.** Bailey, D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-8404109—1). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84007468.

From IEEE symposium on security and privacy; Oakland, CA, USA (30 Apr 1984).

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During the First Session of the 98th Congress, several days of hearings were held on the activities of computer enthusiasts including the Milwaukee 414s and others. The First Session also saw the introduction in the House of six bills dealing with various aspects and computer crime. A summary of those hearings, along with a summary of the pending computer crime bills, will be presented.

19595 **(LBL—14810) Graphic design of program text.** Marcus, A.; Baecker, R. (Lawrence Berkeley Lab., CA (USA); Human Computing Resources Corp., Toronto, Ontario (Canada)). May 1982. Contract AC03-76SF00098. 11p. (CONF-820530—2). NTIS, PC A02/MF A01; 1; GPO Dep. Order Number DE84008162.

From Graphics interface 82 conference; Toronto, Ontario, Canada (17 May 1982).

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Computer programs, like literature, deserve attention not only to conceptual and verbal (linguistic) structure but also to visual structure, i.e., the qualities of alphanumeric text fonts and other graphic symbols, the spatial arrangement of isolated texts and symbols, the temporal sequencing of individual parts of the program, and the use of color (including gray values). With the increasing numbers of programs of ever greater complexity, and with the widespread availability of high resolution raster displays, both soft copy and hard copy, it is essential and possible to enhance significantly the graphic design of program test. The paper summarizes relevant principles from information-oriented graphic design, especially book design, and shows how a standard C program might be translated into a well-designed typographic version. The paper's intention is to acquaint the computer graphics community with the available and relevant concepts, literature, and expertise, and to demonstrate the great potential for the graphic design of computer programs. 22 references.

19596 **(PB—84-141258) Cray Research, Inc. Cray 1-s, Cray FORTRAN translator CFT) version 1.11 Bugfix 1. Validation summary report.** (Office of Software Development, Falls Church, VA (USA). Federal Software Testing Center). 9 Sep 1983. 17p. NTIS, PC E02/MF A01.

This Validation Summary Report (VSR) for the Cray Research, Inc., CRAY FORTRAN Translator (CFT) Version 1.11 Bugfix 1 running under the CRAY Operating System (COS) Version 1.12 provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1978 FOR-

TRAN Standard (X3.9-1978/FIPS PUB 69). The compiler was validated against the Full Level FORTRAN level of FIPS PUB 69. The VSR is made up of several sections showing all the discrepancies found -if any. These include an overview of the validation which lists all categories of discrepancies together with the tests which failed.

19597 **(RIMS—192) Inequalities in von Neumann algebras.** Araki, H. (Kyoto Univ. (Japan). Research Inst. for Mathematical Sciences). Sep 1975. 26p. NTIS (US Sales Only), PC AA03/MF A01. Order Number DE84900759.

Generalization of inequalities involving trace of matrices to von Neumann algebras not having traces in general is discussed. 24 references.

19598 **(UCID—20010) Analysis of a massed versus a dispersed attacking ground force in close combat.** Blumenthal, D.K.; Buzzell, C.A.; Richardson, B.L.; Uzelac, M.J. (Lawrence Livermore National Lab., CA (USA)). 31 Jan 1984. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE84008361.

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A computer simulation of combat is used to compare outcomes of a red tank attack on a blue defense for variations in mass (density) and firepower. Results suggest the defender's need for improvements in fire power to counterbalance the attacker's advantage gained by massing his forces. 22 figures.

19599 **(UCRL—89636) MOLAG: a Method Of Lines Adaptive Grid interface for nonlinear partial differential equations.** Madsen, N.K. (Lawrence Livermore National Lab., CA (USA)). Jul 1983. Contract W-7405-ENG-48. 32p. (CONF-830873—3). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84009161.

From IFIP PDE software conference; Soderkoping, Sweden (22 Aug 1983).

We describe an adaptive grid or moving node method which can be used to solve systems of nonlinear partial differential equations. The method is implemented in the form of a method of lines software interface. When this interface is combined with a reliable ordinary differential equation solver, one obtains the capability to adaptively solve systems of partial differential equations. Numerical results are presented.

19600 **(UIUCDCS-R—83-1155) Improvements to a structured, screen oriented editor.** Shilling, J.J. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Dec 1983. Contract AC02-76ER02383. 41p. (UILU-ENG—83-1732; COO—2383-0103). NTIS, PC A03/MF A01; GPO Dep. Order Number DE84008193.

Thesis.

The fred prototype was written in the springs of 1983 by Alex Orailoglu [Orai83]. The work described in this thesis modified the prototype to develop a working system. For completeness, this thesis gives a full description of the editor, including the parts developed in [Orai83]. Chapter two describes the major data structures and the major software components of the current editor. Chapter three describes the major improvements which were made to the prototype editor. The final chapter deals with future changes to fred.

9903 Information Handling

REFER ALSO TO CITATION(S) 18120, 18267, 18468, 19437, 19581

19601 **(PNL-SA—10227) Tool for interfacing data entry with data base systems.** Lewis, J.R.; Cowley, P.J. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1982. Contract AC06-76RL01830. 9p. (CONF-8206247—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84008322.

From Productivity conference; Seattle, WA, USA (23 Jun 1982).

The productivity of the programming staff at Pacific Northwest Laboratory (PNL) has been enhanced by the development of data entry tools that can be incorporated into any application system. After determining the nature of interactive data entry requirements, a set of software tools were developed by which all interaction with the user is driven through the use of tables. All application specific information such as CRT screen formats, data field descriptions, and sequencing of data on the screen was isolated in these tables thus allowing the software tools to be general in nature and portable to a variety of computers. This concept offers advantages over other data entry packages by allowing the incorporation of application dependent functions into the data entry system while maintaining portability and access to support systems such as data base management systems.

19602 **(UCID—20032) Technology infomation system: transcript of typical demonstration.** McGowan, T.D. (Lawrence Livermore National Lab., CA (USA)). 12 Mar 1984. Contract W-7405-ENG-48. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE84009082.

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A transcript is given of a typical demonstration of the National Criticality Information System. (GHT)

19603 **(UCRL—90419) Mathsy makes math FUN.** Chato, D.M.; Peterson, G. (Lawrence Livermore National Lab., CA (USA)). Feb 1984. Contract W-7405-ENG-48. 9p. (CONF-8310259—1). NTIS, PC A02/MF A01; GPO Dep. Order Number DE84007413.

From EdCompCon conference; San Jose, CA, USA (18 Oct 1983).

Calculators have revolutionized the way we do math. Languages like Mathsy will produce another revolution of similar magnitude. With Mathsy, flexibility and speed combined with graphics give us a better way of seeing both the problem and the solution. Mathsy will enable young students to understand math concepts generally not taught until college, giving them a solid foundation for careers in engineering and science.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Academia Sinica, Beijing (China). Inst. of Energy Conversion
Effect of operating temperature on the HWB model for solar-collector design, 9:18375 (R;US)

Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.
Retrofit cost relationships for hazardous waste incineration. Report for 1 June 1982-1 July 1983, 9:18644 (R;US)

Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.
Modeling study of a cw hf resonance transfer laser medium. Technical report, 9:18910 (R;US)

AeroVironment, Inc., Pasadena, CA (USA)
Comparison of visibility measurement techniques: eastern United States. Final report, 9:19029 (R;US)

AiResearch Mfg. Co., Torrance, CA (USA)
Brayton-cycle solvent recovery system. Phase II. System design, 9:18705 (R;US)

Air Force Geophysics Lab., Hanscom AFB, MA (USA)
Charged particle effects on space systems, 9:18334 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)
Factors affecting the application of a simple ratio technique for spectral correction of a neutron personnel albedo dosimeter. Doctoral thesis, 9:18966 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering
Airborne penetration of radioactive clouds. Master's thesis, 9:19014 (R;US)
Getaway: a model for parametric studies in the area of base escape survivability. Master's thesis, 9:19012 (R;US)
Linear programming, multiple objective approach to nuclear exchange modeling. Master's thesis, 9:19011 (R;US)
Study of the characteristics of high pressure proportional counters for the detection of radioactive noble gases. Master's thesis, 9:18965 (R;US)

Air Force Test and Evaluation Squadron (1815th), Wright-Patterson AFB, OH (USA)
Qualification operational test and evaluation (qotande). test plan for chemical warfare defense ensemble gloves, 9:18894 (R;US)

Air Pollution Technology, Inc., San Diego, CA (USA)
Laboratory/bench scale testing and evaluation of A.P.T. dry plate scrubber. Sixteenth quarterly progress report, December 1, 1983-February 29, 1984, 9:17977 (R;US)

Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Optik und Spektroskopie
Laser fusion target illumination optimization with consideration of the beam divergence, 9:19568 (R;DD)

Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung
Radioisotope application and radiation processing in industry. Selected papers of the second working meeting at Leipzig, 9:18298 (R;DD)
Radioisotopes application and radiation processing in industry. Selected papers of the second working meeting at Leipzig, 28 September-1 October, 1982, 9:18281 (R;DD)

Alabama Geological Survey, University (USA)
Biological and hydrological impacts of surface mining for federal minerals on the Tyro Creek watershed, Alabama. Phase 1. Priming-aquatic baseline information. Report for September 1981-September 1982, 9:17990 (R;US)

American Petroleum Inst., Washington, DC
Market shares and individual company data for US energy markets, 1950-1982, 9:18054 (R;US)

Ames Lab., IA (USA)
Amorphous silicon-carbon thin films, 9:18804 (R;US)
Characterization and chemistry of vinylketene prepared by flash vacuum pyrolysis. Study of the flash vacuum pyrolysis of hydraomatic compounds: 5,8-diphenyltetralin and the parent and substituted 5,6,11,12-tetrahydrodibenzo(a,e)cyclooctenes, 9:18852 (R;US)
Homo- and heteropolyatomic anions of the post-transition elements of Group IV and V: synthesis and crystal structure characterization, 9:18843 (R;US)
Mode-to-mode vibrational energy transfer in $^1B_2$ aniline induced by collisions with CO_2, 9:18863 (R;US)
Recycling, heat exchange, and comminution, as means of improving the energy yield from an on-farm anaerobic digester for beef manure, 9:18312 (R;US)
Resistivity and strain behavior during transformation cycling in nickel-titanium, 9:18752 (R;US)
Thermotransport of hydrogen in niobium and tantalum as a function of hydrogen concentration, 9:18751 (R;US)
Upper limit for the methane-oxygen initiation reaction in the presence of iodine-131 behind reflected shock waves, 9:18883 (R;US)

Amoco Research Center, Naperville, IL (USA)
Advanced coal liquefaction catalyst development. Quarterly progress report No. 8, 9:17946 (R;US)

Amstutz (Dean), Bloomfield, IA (USA)
Development of a geothermal heat pump. Final report, 9:18689 (R;US)

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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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	9:18929	LBL—17244
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	9:19376	LBL—16846
	9:19595	LBL—14810
AC03-76SF00515	Stanford Linear Accelerator Center, CA (USA)	
	9:18952	DOE/SF/00515—T27
	9:18957	SLAC—96
	9:18998	SLAC-TN—84-1
	9:19349	SLAC-PUB—3242
	9:19377	SLAC-PUB—3280
AC03-80ET34034	General Electric Co., Schenectady, NY (USA). Turbine Technology Lab.	
	9:18449	DOE/ET/34034—93
AC03-80SF11445	Stanford Univ., CA (USA). Petroleum Research Inst.	
	9:18047	DOE/SF/11445—2
AC04-76DP00613	Bendix Corp., Kansas City, MO (USA)	
	9:18884	BDX—613-2993
	9:18917	BDX—613-2911
AC04-76DP00656	General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.	
	9:19220	GEPP-TIS—786
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AC04-76DP00789	Sandia National Labs., Albuquerque, NM (USA)	
	9:18049	SAND—83-0756
	9:18071	SAND—83-0060
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	9:18083	Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical an
AC04-76DP00789	Sandia National Labs., Albuquerque, NM (USA)	
	9:18133	SAND—83-2550C
	9:18134	SAND—84-0516C
	9:18135	SAND—84-0571C
	9:18185	SAND—77-0962C
	9:18186	SAND—83-0144
	9:18187	SAND—83-1646
	9:18188	SAND—83-2043C
	9:18256	SAND—83-2042C
	9:18257	SAND—83-2044C
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	9:18358	SAND—84-1074C
	Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)	
	9:18366	DOE/DP/00789—T92
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AC04-79AL10563	Republic Geothermal, Inc., Santa Fe Springs, CA (USA)	
	9:18391	DOE/AL/10563—T18
AC05-76ET10434	Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.	
	9:17930	BAW/ARC—5259
AC05-76OR00001	Goodyear Atomic Corp., Piketon, OH (USA). Chemical Analysis Dept.	
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AC05-77ET11289	General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.	
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AC05-84OR21400	Oak Ridge National Lab., TN (USA)	
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	9:18691	ORNL/CON—100
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AC06-76FF02170	Hanford Engineering Development Lab., Richland, WA (USA)	
	9:18115	HEDL-SA—2969-FP
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	9:18455	HEDL-SA—2842-FP
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	9:18457	NE-E—13-6T-Rev.
	9:18458	NE-M—14-2T-Rev.
	9:18491	HEDL-SA—3078-FP
	9:18512	HEDL-SA—3074-S
	9:19537	HEDL-SA—2927-FP
AC06-76RL01830	Pacific Northwest Lab., Richland, WA (USA)	
	9:17963	PNL—4962
	9:18124	PNL—4976
	9:18176	NUREG/CR—3674
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	9:18180	PNL-SA—11680
	9:18181	PNL-SA—11771
	9:18182	PNL-SA—11805
	9:18183	PNL-SA—11818
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AC06-76RL01857	**UNC Nuclear Industries, Inc., Richland, WA (USA)**	
	9:18136	UNI—2758
AC06-82RL10367	**Raymond Kaiser Engineers, Inc., Oakland, CA (USA)**	
	9:18171	KEH/R—83-96
AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
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AC08-79NV10058	**Nevada Bureau of Mines and Geology, Reno (USA)**	
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AC08-80DP40124	**Rochester Univ., NY (USA). Lab. for Laser Energetics**	
	9:19488	DOE/DP/40124—20
AC08-82NV10249	**CER Corp., Las Vegas, NV (USA)**	
	9:18066	DOE/NV/10249—7
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	9:18068	DOE/NV/10249—T3
	9:18069	DOE/NV/10249—T4
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AC08-82NV10250	**Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.**	
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	9:18165	DP-MS—84-11
	9:18166	DP-MS—84-19
	9:18167	DPST—83-288
	9:18261	DP-MS—83-142
	9:18299	DP-MS—83-83
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AC09-79ET41900	**Rockwell International Science Center, Thousand Oaks, CA**	
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AC20-78ET13101	**University of Wyoming, Chemical Engineering Department, Laramie, WY**	
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AC21-79MC11843	**E.I. du Pont de Nemours & Co., Inc.**	
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AC21-80ET15492	**Air Pollution Technology, Inc., San Diego, CA (USA)**	
	9:17977	DOE/ET/15492—T47
AC21-80MC14645	**Univ. of Tulsa**	
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AC21-82MC19330	**Little (Arthur D.), Inc., Cambridge, MA (USA)**	
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AC22-76ET10532	**Chevron Research Co., Richmond, CA (USA)**	
	9:17939	DOE/ET/10532—T16
AC22-78ET10735	**Catalysis Research Corp., Palisades Park, NJ (USA)**	
	9:17940	DOE/ET/10735—T2
AC22-80PC30013	**Pennsylvania State Univ., University Park (USA)**	
	9:17970	DOE/PC/30013—T5
AC22-80PC30075	**Massachusetts Inst. of Tech., Cambridge (USA)**	
	9:17945	DOE/PC/30075—T1
AC22-80PC30145	**North Carolina State Univ., Raleigh (USA). Dept. of Chemical Engineering**	
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AC22-80PC30185	**Atlantic Research Corp., Alexandria, VA (USA)**	
	9:18034	DOE/PC/30185—T3
AC22-80PC30301	**Battelle Columbus Labs., OH (USA)**	
	9:18035	DOE/PC/30301—11

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AC22-81MC16229	**Florida State Universty, Tallahassee, Florida**	
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AC22-81PC40009	**Amoco Research Center, Naperville, IL (USA)**	
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AC22-82FE60088	**Avco-Everett Research Lab., Inc., Everett, MA (USA)**	
	9:17978	DOE/FE/60088—T1
AC22-82PC50041	**Catalytic, Inc., Wilsonville, AL (USA)**	
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AC22-83PC60048	**Kerr-McGee Corp., Oklahoma City, OK (USA). Project Engineering Dept.**	
	9:17951	DOE/PC/60048—1
AC22-83PC60262	**Rockwell International Corp., Canoga Park, CA (USA)**	
	9:17981	DOE/PC/60262—T1
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AC22-83PC60265	**Science Applications, Inc., San Diego, CA (USA)**	
	9:18408	DOE/PC/60265—T1
AI01-76ET10393	**NCB (IEA Grimethorpe) Ltd., Grimethorpe, Barnsley, South Yorkshire (UK)**	
	9:18934	DOE/ET/10393—1528
AI01-77ET20004	**Department of Agriculture, St. Paul, MN (USA)**	
	9:18346	DOE/ET/20004—T2
AI01-80ER52065	**National Academy of Sciences, Washington, DC (USA)**	
	9:18732	DOE/ER/52065—T1
AI08-79DP40092	**Naval Research Lab., Washington, DC (USA)**	
	9:19564	NRL-MR—5237
AI09-76SR00870	**Forest Service, Athens, GA (USA). Inst. for Mycorrhizal Research and Development**	
	9:19058	DOE/SR/00870—34
	9:19166	DOE/SR/00870—33
	9:19167	DOE/SR/00870—35
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AI21-77ET13111	**United Technologies Corp., South Windsor, CT (USA). Power Systems Div.**	
	9:18400	DOE/NASA/0030—80/4
AI21-80ET17088	**Trane Co., La Crosse, WI (USA)**	
	9:18674	DOE/NASA/0241—12
	Little (Arthur D.), Inc., Cambridge, MA (USA)	
	9:18675	DOE/NASA/0291—1
AM01-76EI02295	**Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.**	
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AM03-82ER40071	**California State Univ., Northridge (USA)**	
	9:19253	DOE/ER/40071—1
AS04-76ET33626		
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AS05-76ER02968	**Pittsburgh Univ., PA (USA**	
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AS05-76EV03018	**Univ. of Texas, San Antonio**	
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AS05-76EV03018	**Louisiana State Univ., Baton Rouge**	
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AS05-76EV04703	**Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy**	
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AS05-76EV04946	**Tennessee Univ., Knoxville (USA). Dept. of Civil Engineering**	
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AS05-77ER05528	**Texas Univ., Austin (USA). Dept. of Chemistry**	
	9:18301	DOE/ER/05528—66
AS05-78EV05784	**Florida State Univ., Tallahassee (USA)**	
	9:19255	DOE/OR/05784—6
AS05-79ER10418	**Georgia State Univ., Atlanta (USA)**	
	9:18973	DOE/ER/10418—3
AS05-80ER10655	**Florida State Univ., Tallahassee (USA)**	
	9:18780	DOE/ER/10655—5
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	9:18781	DOE/ER/10655—T1
AS05-83ER45045	**North Carolina Agricultural and Technical State Univ., Greensboro (USA)**	
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AS09-76EV00637	**Univ. of Georgia, Tifton**	
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AS09-76EV00641	**Georgia Univ., Athens (USA). Dept. of Entomology**	
	9:19069	DOE/EV/00641—49
AS19-81BC10412	**GURC, Bellaire, TX (USA)**	
	9:18045	DOE/BC/10412—44
AT03-76ET35300	**GA Technologies, Inc., San Diego, CA (USA)**	
	9:18450	GA-A—17369
AT03-76ET35301	**GA Technologies, Inc., San Diego, CA (USA)**	
	9:18451	GA-A—17381
AT03-76ET51011	**GA Technologies, Inc., San Diego, CA (USA)**	
	9:19527	GA-A—17209
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	9:19530	GA-A—17215
	9:19531	GA-A—17216
	9:19532	GA-A—17217
	9:19533	GA-A—17218
	9:19534	GA-A—17219
	9:19535	GA-A—17324
AT03-76EV70007	**Stanford Univ., CA (USA)**	
	9:19139	DOE/EV/70007—T1
AT03-76SF72025	**Borg-Warner Corp., Carson, CA (USA). Byron Jackson Pump Div.**	
	9:18454	CONF-830702—20
AT03-83CE89302	**California Univ., Berkeley (USA). Marine Sciences Div.**	
	9:18369	CONF-830667—2
FC01-80CS22046	**National Inst. of Building Sciences, Washington, DC (USA)**	
	9:18683	DOE/CS/22046—T1-Vol.1
	9:18684	DOE/CS/22046—T1-Vol.2
	9:18685	DOE/CS/22046—T1-Vol.3
FC03-78ET27163	**Public Service Co. of New Mexico, Albuquerque (USA)**	
	9:18390	DOE/ET/27163—T4
FC04-77ET20216	**Georgia Power Co., Atlanta (USA)**	
	9:18364	ALO—3994-83/2
FC05-77ET10069	**Exxon Research and Engineering Co., Florham Park, NJ (USA)**	
	9:17935	DOE/ET/10069—T82
	9:17936	DOE/ET/10069—T83
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	Combustion Engineering, Inc., Windsor, CT (USA). Kreisinger Development Lab.	
	9:17938	DOE/ET/10069—T85
FC07-79ID12063	**Earth Sciences, Inc., Golden, CO (USA)**	
	9:18385	DOE/ID/12063—T1

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FC07-80ID12122	**Public Service Co. of New Hampshire, Manchester (USA)**	
	9:18329	DOE/ID/12122—1
FC07-83ID12439	**Rexnord, Inc., Milwaukee, WI (USA). Process Machinery Div.**	
	9:18707	DOE/ID/12439—T1
FC21-83FE60181	**North Dakota Univ., Grand Forks (USA). Energy Research Center**	
	9:17941	DOE/FE/60181—51
	9:17942	DOE/FE/60181—56
	9:17943	DOE/FE/60181—59
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	9:18033	DOE/FE/60181—29
FC22-83FE60339	**Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center**	
	9:17917	DOE/FE/60339—2
FG01-78CS54273	**Texas A and M Univ., College Station (USA). Dept. of Mechanical Engineering**	
	9:18731	DOE/CS/54273—T1
FG01-79CS20291	**Pacific Gas and Electric Co., San Francisco, CA (USA)**	
	9:18719	DOE/CS/20291—T2
	9:18720	DOE/CS/20291—T3
	Science Applications, Inc., La Jolla, CA (USA)	
	9:18721	DOE/CS/20291—T4
	Pacific Gas and Electric Co., San Francisco, CA (USA)	
	9:18722	DOE/CS/20291—T5
FG01-79CS20542	**Pennsylvania State Government, Harrisburg (USA)**	
	9:18662	DOE/CS/20542—T1
FG01-80CS15022	**Fuel Injection Development Corp., Cherry Hill, NJ (USA)**	
	9:18734	CONF-800202—4
FG01-80CS40338	**North Carolina State Univ., Raleigh (USA). Dept. of Mechanical Engineering**	
	9:18057	DOE/CS/40338—4
FG01-80CS65004	**Cooper Union Research Foundation, New York (USA)**	
	9:18655	DOE/CS/65004—T2
FG01-81AD11261	**Morgan State Univ., Baltimore, MD (USA). Inst. for Urban Research**	
	9:18725	DOE/AD/11261—T1
FG01-81CS15038	**Count Digital Ltd., Arlington, MA (USA)**	
	9:18682	DOE/CS/15038—T1
FG01-81ER12001	**National Academy of Sciences - National Research Council, Washington, DC (USA)**	
	9:19480	DOE/ER/12001—T1
FG01-82CE15130	**Underground Systems, Arcadia, CA (USA)**	
	9:17995	CAPE—2931(8 Mar 1984).
	9:17996	CAPE—2932(22 Nov 1983).
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FG02-79ER10534	**University of Southern Mississippi, Hattiesburg (USA)**	
	9:18342	DOE/ER/10534—3
	9:18343	DOE/ER/10534—T1
	9:18344	DOE/ER/10534—T2
FG02-79ER10539	**North Carolina State Univ., Raleigh (USA)**	
	9:18345	DOE/ER/10539—T1
FG02-79ER10545	**Arizona State Univ., Tempe (USA). Dept. of Chemistry**	
	9:18862	DOE/ER/10545—1
FG02-79ET00082	**Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemistry**	
	9:18842	DOE/ET/00082—T1
FG02-80CS83100	**Clark Univ., Worcester, MA (USA)**	
	9:18340	DOE/CS/83100—T1
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242	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009079	MN -70	9:18151
243	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009388	MN -70	9:18152
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19	NTIS, PC A02/MF A01 (GPO Dep.)	DE83018274	MN -70A	9:18250
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83-4	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009124	STD -90a	9:17921
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84-04	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007302	MN -28	9:18944
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413	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84009357	MN -32	9:19589
414	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009356	MN -13	9:19575
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26	National Research Council of Canada, Halifax, Nova Scotia			9:17922
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5259	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84007961	MN -90h	9:17930
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83-018	NTIS (US Sales Only), PC A08/MF A01; 1	DE84750495	MN -88	9:18039
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83-190	NTIS (US Sales Only), PC A08/MF A01; 1	DE84750488	MN -92	9:18065
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83-218	NTIS (US Sales Only), PC A19/MF A01	DE84750515	MN -70	9:19229
83-221	NTIS (US Sales Only), PC A12/MF A01; 1	DE84750501	MN -95e	9:18716
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1983-003	NTIS (US Sales Only), PC A11/MF A01	DE84750751	MN -70B	9:18153
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526	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009958	STD -70	9:18154
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34087	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008175	MN -90	9:17932
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34235	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007378	MN -28	9:18948
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51719	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007805	STD -97a	9:18411
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83-15	NTIS (US Sales Only), PC A02/MF A01	DE84750895	MN -34C	9:19380
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83-18	NTIS (US Sales Only), PC A02/MF A01	DE84750894	MN -34D	9:19300
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6645	NTIS (US Sales Only), PC A03/MF A01	DE84700121	MN -28	9:18958
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5213(pt.1)	NTIS (US Sales Only), PC A09/MF A01	DE84700112	MN -23	9:18970
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216	NTIS (US Sales Only), PC A02/MF A01	DE84700093	MN -48	9:19172
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2381-6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006935	MN -33	9:18496
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2381-17	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007009	MN -33	9:18501
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5302	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007050	MN -33	9:18503
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8/ 83	*See* PB-84-132711			9:18060
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	See IWGFPT-1	DE84900849	MN -78	9:18428
CONF-770847-	(15. international thermal conductivity conference, Ottawa, Ontario, Canada, 24-26 Aug 1977)			
10	*See* SAND-77-0962C	DE84009049	MN -70	9:18185
CONF-7911194-	(7. NIRS seminar on enrivonmental research, Anagawa, Chiba, Japan, 12 Jan 1997)			
	See NIRS-M-35	DE84780136	MN -11	9:19055
CONF-800202-	(SAE automotive engineering congress and exposition, Detroit, MI, USA, 25-29 Feb 1980)			
4	Society of Automotive Engineers, Inc., 400 Commonwealth Dr., Warrendale, PA 15096		ND -96	9:18734
CONF-8003192-	(Conference on geotechnology in Massachusetts, Boston, MA, USA, 20-21 Mar 1980)			
	University of Massachusetts, Amherst 01003			9:19224
CONF-801053-	(8. water reactor safety research information meeting, Gaithersburg, MD, USA, 27-31 Oct 1980)			
14	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007552	MN -78	9:18508
CONF-8011205-	(8. NIRS environmental seminar on biological concentration in the ocean and factors influencing it, Chiba, Japan, 27 Nov 1980)			
	See NIRS-M-39	DE84780137	MN -11	9:19110
CONF-810620-	(4. international topical conference on high-power electron and ion-beam research and technology, Palaiseau, France, 29 Jun-3 Jul 1981)			
23	*See* UCRL-88925	DE84007786	MN -21	9:19567
CONF-810812-	(16. intersociety energy conversion engineering conference (IECEC), Atlanta, GA, USA, 9-14 Aug 1981)			
61-Draft	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007592	MN -95e	9:18304
CONF-810831-	(2. fusion reactor materials meeting, Seattle, WA, USA, 9-12 Aug 1981)			
108-Draft	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007600	MN -20c	9:19525
CONF-8108172-	(Annual scientific meeting of the Australian Institute of Medical Laboratory scientists, Melbourne, Australia, 19-21 Aug 1981)			
1-Draft	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007593	MN -48	9:19130
CONF-811108-	(Annual meeting of the American Institute of Chemical Engineers, New Orleans, LA, USA, 8-12 Nov 1981)			
26	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007526	MN -61E	9:18305
CONF-811298-	(Materials colloquium on ceramics as construction materials, Koeln-Porz, F.R. Germany, 3 Dec 1981)			
Summs.	NTIS (US Sales Only), PC A03/MF A01; 1	DE84770162	MN -25	9:18771
CONF-820530-	(Graphics interface 82 conference, Toronto, Ontario, Canada, 17 May 1982)			
2	*See* LBL-14810	DE84008162	MN -32	9:19595
CONF-8205246-	(2. joint seminar on atomic collisions and heavy ion induced nuclear reactions, Tokyo, Japan, 13-14 May 1982)			
	See JAERI-M-82-159	DE84700704	MN -34C	9:19434
CONF-8205249-	(2. international workshop on reactive metal-air batteries, Palo Alto, CA, USA, 1 May 1982)			
1	*See* UCRL-90468	DE84008327	MN -94ce	9:18733
CONF-820667-	(5. international workshop on HgI/sub 2/ nuclear radiation detectors, Jerusalem, Israel, 6-8 Jun 1982)			
	Nucl. Instrum. Methods Phys. Res., 213: No. 1, 5-12(15 Jul 1983)			9:18810
	Nucl. Instrum. Methods Phys. Res., 213: No. 1, 89-94(15 Jul 1983)			9:18987
CONF-8206149-	(21. Euratom workshop on hot laboratories and remote handling, Mol, Belgium, 10-11 Jun 1982)			
5	*See* GKSS-82/E/54	DE84750518	MN -80	9:18740
CONF-8206247-	(Productivity conference, Seattle, WA, USA, 23-26 Jun 1982)			
1	*See* PNL-SA-10227	DE84008322	MN -32	9:19601
CONF-820718-	(21. international conference on high energy physics, Paris, France, 26-31 Jul 1982)			
50	*See* JINR-E-1-82-760	DE84700689	MN -34D	9:19293
CONF-820864-	(4. europhysical topical conference on lattice defects in ionic crystals, Dublin, Ireland, 30 Aug-3 Sep 1982)			
	Radiat. Eff., 74: No. 1-4, 151-159(Aug 1983)			9:18247
CONF-820922-	(4. international symposium on wind energy systems, Stockholm, Sweden, 21-24 Sep 1982)			
	Int. Symp. Wind Energy Syst., Proc., 1: 119-130(Sep 1982)			9:18396
	Int. Symp. Wind Energy Syst., Proc., 1: 75-92(Sep 1982)			9:18397
	Int. Symp. Wind Energy Syst., Proc., 1: 141-154(Sep 1982)			9:18398

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CONF-820945-	(International conference on ion beam modification of materials, Grenoble, France, 6-10 Sep 1982)			
	Nucl. Instrum. Methods Phys. Res., 209/210: 421-426(May 1983)			9:18767
	Nucl. Instrum. Methods Phys. Res., 209/210: 453-459(May 1983)			9:18768
	Nucl. Instrum. Methods Phys. Res., 209/210: 33-36(May 1983)			9:18812
	Nucl. Instrum. Methods Phys. Res., 209/210: 239-242(May 1983)			9:18813
	Nucl. Instrum. Methods Phys. Res., 209/210: 317-323(May 1983)			9:18814
	Nucl. Instrum. Methods Phys. Res., 209/210: 345-350(May 1983)			9:18815
	Nucl. Instrum. Methods Phys. Res., 209/210: 407-412(May 1983)			9:18816
CONF-8209165-	(2. working meeting radioisotope application and radiation processing in industry, Leipzig, German D.R., 28 Sep-1 Oct 1982)			
Suppl.	*See* Zfl-Mitt-70	DE84780089	MN -23	9:18298
CONF-8209206-	(2. working meeting on radioisotope application and radiation processing in industry, Leipzig, German D.R., 28 Sep-1 Oct 1982)			
	See ZFI-Mitt-69	DE84780139	MN -25	9:18281
CONF-8209207-	(Meeting on tracer methods in isotope hydrology, Vienna, Austria, 27 Sep-1 Oct 1982)			
	See IAEA-TECDOC-291	DE84780144	MN -11	9:19087
CONF-821037-	(10. water reactor safety research information conference, Gaithersburg, MD, USA, 12-15 Oct 1982)			
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CONF-821048-	(5. Life Sciences symposium on synthetic fossil fuel technologies, Gatlinburg, TN, USA, 24-27 Oct 1982)			
10	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84001951	MN -90i	9:17987
CONF-8210110-	(International symposium on biological dosimetry, Neuherberg, F.R. Germany, 14-16 Oct 1982)			
4	*See* UCRL-88226	DE83007350	MN -48	9:19206
CONF-8210120-	(Intergrated data users workshop, Reston, VA, USA, 13 Oct 1982)			
1	*See* LBL-15075	DE84008008	MN -11	9:18641
CONF-8210133-	(8. All-Union conference on charged particles accelerators, Protvino, USSR, 19-21 Oct 1982)			
3	*See* JINR-R-16-82-629	DE84700693	MN -46	9:19439
CONF-8210143-	(Symposium on waves on fluid interfaces, Madison, WI, USA, 18-20 Oct 1982)			
	Academic Press, Inc., 111 Fifth Ave., New York, NY 10003		ND -32	9:19271
CONF-8210188-	(European Federation of Chemical Engineers conference on energy, London, UK, 12-15 Oct 1982)			
	Inst. Chem. Eng. Symp. Ser., 78: T6/57-T6/66(Oct 1982)			9:18363
	Inst. Chem. Eng. Symp. Ser., 78: T6/27-T6/41(Oct 1982)			9:18378
CONF-8210219-	(8. MPA seminar, Stuttgart, F.R. Germany, 14-15 Oct 1982)			
	See INIS-mf-8362	DE84780071	MN -25	9:18470
CONF-8210237-	(9. international conference on nuclear energy - world nuclear fuel market, Nice, France, 17-20 Oct 1982)			
	Nuclear Assurance Corp., 24 Executive Park West, Atlanta, GA 30329			9:18111
CONF-8210250-	(Workshop on transmission system reliability methods, Washington, DC, USA, 28-29 Oct 1982)			
	See EPRI-EL-3306		ND -97a	9:18414
CONF-8210253-	(Pacific conference on chemistry and spectroscopy, San Francisco, CA, USA, 27-29 Oct 1982)			
1	*See* UCRL-87651	DE84007784	MN -48	9:19205
CONF-821145-	(7. materials for coal conversion and utilization conference, Gaithersburg, MD, USA, 16-18 Nov 1982)			
7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007610	MN -90d	9:17933
CONF-821203-	(International conference on lasers, New Orleans, LA, USA, 13-17 Dec 1982)			
7	*See* CEA-CONF-6645	DE84700121	MN -28	9:18958
CONF-830308-	(American Institute of Chemical Engineers national meeting, Houston, TX, USA, 27-31 Mar 1983)			
14	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007428	MN -61A	9:18306
CONF-830311-	(Particle accelerator conference, Santa Fe, NM, USA, 21-23 Mar 1983)			
189	*See* LAL-RT-83-03	DE84700124	MN -28	9:18955
CONF-8303135-	(4. crossborder seminar, Calgary, Alberta, Canada, 10 Mar 1983)			
1	NTIS, PC A03/MF A01; 1	DE84900866	MN -92	9:18072
CONF-830483-	(5. international symposium on coal slurry combustion and technology, Tampa, FL, USA, 25-27 Apr 1983)			
3	NTIS, PC A02; 3 (GPO Dep.)	DE84009321	MN -90b	9:18031
4	NTIS, PC A03; 3 (GPO Dep.)	DE84009322	MN -90	9:18037

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CONF-8304101-	(7. American Society of Testing and Materials symposium on aquatic toxicology, Milwaukee, WI, USA, 17-19 Apr 1983)			
3	*See* PNL-SA-10845	DE84002597	MN -48	9:19090
CONF-8304110-	(5. international workshop on photon-photon collisions, Aachen, F.R. Germany, 13-16 Apr 1983)			
5	*See* DESY-83-059	DE84750250	MN -34D	9:19280
CONF-8304142-	(7. international conference on meson spectroscopy, Upton, NY, USA, 14-16 Apr 1983)			
2	*See* BNL-34208	DE84008170	MN -34D	9:19274
CONF-8305119-	(4. Warsaw symposium of elementary particles, Kazimierz, Poland, 30 May-3 Jun 1983)			
3	*See* BONN-HE-83-18	DE84750894	MN -34D	9:19300
CONF-830607-	(American Society of Mechanical Engineers pressure vessel and piping conference, Portland, OR, USA, 19-24 Jun 1983)			
32	*See* HEDL-SA-2842-FP	DE84006564	MN -79h	9:18455
CONF-830667-	(3. symposium on coastal and ocean management, San Diego, CA, USA, 1-4 Jun 1983)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84005040	MN -64	9:18369
CONF-830697-	(International conference on nonlinear electrodynamics in biological systems, Loma Linda, CA, USA, 5-10 Jun 1983)			
4	*See* LA-UR-84-429	DE84007505	MN -48	9:19593
CONF-830702-	(21. ASME/AIChE national heat transfer conference, Seattle, WA, USA, 24-28 Jul 1983)			
20	NTIS MF A01; 2 (GPO Dep.)	DE83015538	MN -79k	9:18454
CONF-830704-	(9. international colloquium on dynamics of explosions and reactive systems, Poitier, France, 3-8 Jul 1983)			
9-Rev.1	*See* UCRL-88760-Rev.1	DE84008331	MN -34A	9:19002
CONF-830709-	(24. annual meeting of the Institute of Nuclear Materials Management, Vail, CO, USA, 10-13 Jul 1983)			
29	*See* Y/DG-16210	DE84008266	MN -16	9:18273
30	*See* Y/DG-16209	DE84008268	MN -16	9:18272
CONF-830718-	(International Europhysics conference on high energy physics, Brighton, UK, 20-27 Jul 1983)			
	See MPI-PAE/Exp.El.-122			9:19298
17	*See* BNL-34308	DE84008179	MN -34D	9:19275
18	*See* BNL-34317	DE84008183	MN -34D	9:19276
CONF-8307109-	(11. SLAC summer institute conference on particle physics - dynamics and spectroscopy at high energy, Stanford, CA, USA, 18-29 Jul 1983)			
8	*See* SLAC-PUB-3242	DE84007919	MN -34D	9:19349
CONF-830841-	(Cryogenic engineering conference and international cryogenic materials conference, Colorado Springs, CO, USA, 15-19 Aug 1983)			
32	*See* LBL-16535	DE84008250	MN -25	9:18897
CONF-830859-	(National meeting of the American Institute of Chemical Engineers, Denver, CO, USA, 28-31 Aug 1983)			
13	NTIS, PC A02; 3 (GPO Dep.)	DE84009103	MN -94cc	9:18630
CONF-830873-	(IFIP PDE software conference, Soderkoping, Sweden, 22-26 Aug 1983)			
3	*See* UCRL-89636	DE84009161	MN -38	9:19599
CONF-830887-	(Joint meeting of American Crystallographic Association and Denver X-ray conference, Snowmass, CO, USA, 1 Aug 1983)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007890	MN -25	9:18788
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007891	MN -25	9:18993
CONF-8308101-	(International symposium on lepton and photon interactions at high energies, Ithaca, NY, USA, 4-9 Sep 1983)			
5	*See* DESY-83-067	DE84750253	MN -34D	9:19284
CONF-8308161-	(Symposium on order on polymeric materials: implications for electronic, magnetic, and optical phenomena, Waltham, MA, USA, 25-26 Aug 1983)			
1	*See* SAND-83-1063C	DE84007572	MN -25	9:18784
CONF-830929-	(8. national passive solar conference, Santa Fe, NM, USA, 5-10 Sep 1983)			
9	*See* SERI/TP-254-2020	DE83011986	STD -59c	9:18373
CONF-830932-	(International conference on numerical methods in nuclear engineering, Montreal, Canada, 6-9 Sep 1983)			
7	*See* LA-UR-83-2150	DE83015221	MN -34C	9:19456
CONF-830959-	(12. international colloquium on group theoretical methods in physics, Trieste, Italy, 5-10 Sep 1983)			
1	*See* BONN-HE-83-16	DE84750892	MN -34D	9:19361
CONF-8309105-	(International seminar on criticality experiments and data, Dijon, France, 20-23 Sep 1983)			
2	*See* UCRL-89660	DE84008382	MN -46	9:18265
CONF-8309118-	(Topical meeting on free electron generation of extreme ultraviolet coherent radiation, Upton, NY, USA, 19-22 Sep 1983)			
8	*See* BNL-34340	DE84008172	MN -28	9:18945
CONF-8309214-	(NATO conference on marine photochemistry, Woods Hole, MA, USA, 1 Sep 1983)			
1	*See* DOE/ER/05528-66	DE84007214	MN -61G	9:18301
CONF-8309220-	(Quark matter '83 workshop, Upton, NY, USA, 1 Sep 1983)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007430	MN -34D	9:19302

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CONF-831002-	(International symposium on biological dosimetry, approaches to mammalian systems, Nueherberg, F.R. Germany, 14-16 Oct 1983)			
2	*See* UCRL-89398	DE83014449	MN -48	9:19207
3	*See* UCRL-89431	DE83014871	MN -21	9:19208
CONF-831015-	(Nuclear science symposium, San Francisco, CA, USA, 19-21 Oct 1983)			
38	*See* FERMILAB-Conf-84/23-E	DE84007248	MN -37	9:18976
39	*See* FERMILAB-Conf-84/22-E	DE84007247	MN -37	9:18975
CONF-831025-	(26. ORNL-DOE conference on analytical chemistry in energy technology, Knoxville, TN, USA, 11-13 Oct 1983)			
30	*See* PNL-SA-11455	DE84008287	MN -4	9:18830
31	*See* PNL-SA-11787	DE84008289	MN -4	9:18831
CONF-831047-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 30 Oct-4 Nov 1983)			
	Trans. Am. Nucl. Soc., 45: 60-61(Oct 1983)			9:18086
	Trans. Am. Nucl. Soc., 45: 136-137(Oct 1983)			9:18126
	Trans. Am. Nucl. Soc., 45: 81(Oct 1983)			9:18137
	Trans. Am. Nucl. Soc., 45: 134-135(Oct 1983)			9:18138
	Trans. Am. Nucl. Soc., 45: 133-134(Oct 1983)			9:18139
	Trans. Am. Nucl. Soc., 45: 119(Oct 1983)			9:18140
	Trans. Am. Nucl. Soc., 45: 118-119(Oct 1983)			9:18141
	Trans. Am. Nucl. Soc., 45: 86-87(Oct 1983)			9:18142
	Trans. Am. Nucl. Soc., 45: 85(Oct 1983)			9:18143
	Trans. Am. Nucl. Soc., 45: 85(Oct 1983)			9:18144
	Trans. Am. Nucl. Soc., 45: 81-84(Oct 1983)			9:18145
	Trans. Am. Nucl. Soc., 45: 142-143(Oct 1983)			9:18191
	Trans. Am. Nucl. Soc., 45: 46-47(Oct 1983)			9:18192
	Trans. Am. Nucl. Soc., 45: 168-169(Oct 1983)			9:18193
	Trans. Am. Nucl. Soc., 45: 153(Oct 1983)			9:18194
	Trans. Am. Nucl. Soc., 45: 120-121(Oct 1983)			9:18195
	Trans. Am. Nucl. Soc., 45: 114-115(Oct 1983)			9:18196
	Trans. Am. Nucl. Soc., 45: 112-113(Oct 1983)			9:18197
	Trans. Am. Nucl. Soc., 45: 155-156(Oct 1983)			9:18198
	Trans. Am. Nucl. Soc., 45: 156-157(Oct 1983)			9:18199
	Trans. Am. Nucl. Soc., 45: 164(Oct 1983)			9:18200
	Trans. Am. Nucl. Soc., 45: 163-164(Oct 1983)			9:18201
	Trans. Am. Nucl. Soc., 45: 159-160(Oct 1983)			9:18202
	Trans. Am. Nucl. Soc., 45: 154-155(Oct 1983)			9:18203
	Trans. Am. Nucl. Soc., 45: 153-154(Oct 1983)			9:18204
	Trans. Am. Nucl. Soc., 45: 147-148(Oct 1983)			9:18205
	Trans. Am. Nucl. Soc., 45: 131-133(Oct 1983)			9:18206
	Trans. Am. Nucl. Soc., 45: 113-114(Oct 1983)			9:18207
	Trans. Am. Nucl. Soc., 45: 794-795(Oct 1983)			9:18208
	Trans. Am. Nucl. Soc., 45: 139-141(Oct 1983)			9:18209
	Trans. Am. Nucl. Soc., 45: 88(Oct 1983)			9:18210
	Trans. Am. Nucl. Soc., 45: 117-118(Oct 1983)			9:18211
	Trans. Am. Nucl. Soc., 45: 126(Oct 1983)			9:18212
	Trans. Am. Nucl. Soc., 45: 125(Oct 1983)			9:18213
	Trans. Am. Nucl. Soc., 45: 170-171(Oct 1983)			9:18214
	Trans. Am. Nucl. Soc., 45: 169(Oct 1983)			9:18215
	Trans. Am. Nucl. Soc., 45: 167-168(Oct 1983)			9:18216
	Trans. Am. Nucl. Soc., 45: 166-167(Oct 1983)			9:18217
	Trans. Am. Nucl. Soc., 45: 165(Oct 1983)			9:18218
	Trans. Am. Nucl. Soc., 45: 157-158(Oct 1983)			9:18219
	Trans. Am. Nucl. Soc., 45: 151-152(Oct 1983)			9:18220
	Trans. Am. Nucl. Soc., 149-151(Oct 1983)			9:18221
	Trans. Am. Nucl. Soc., 45: 148-149(Oct 1983)			9:18222
	Trans. Am. Nucl. Soc., 45: 146-147(Oct 1983)			9:18223
	Trans. Am. Nucl. Soc., 45: 145-146(Oct 1983)			9:18224
	Trans. Am. Nucl. Soc., 45: 141-142(Oct 1983)			9:18225
	Trans. Am. Nucl. Soc., 45: 128-129(Oct 1983)			9:18226
	Trans. Am. Nucl. Soc., 45: 128(Oct 1983)			9:18227
	Trans. Am. Nucl. Soc., 45: 127(Oct 1983)			9:18228
	Trans. Am. Nucl. Soc., 45: 126-127(Oct 1983)			9:18229
	Trans. Am. Nucl. Soc., 45: 125-126(Oct 1983)			9:18230
	Trans. Am. Nucl. Soc., 45: 123-124(Oct 1983)			9:18231
	Trans. Am. Nucl. Soc., 45: 121-123(Oct 1983)			9:18232
	Trans. Am. Nucl. Soc., 45: 119-120(Oct 1983)			9:18233
	Trans. Am. Nucl. Soc., 45: 115-116(Oct 1983)			9:18234
	Trans. Am. Nucl. Soc., 45: 110-111(Oct 1983)			9:18235
	Trans. Am. Nucl. Soc., 45: 108-109(Oct 1983)			9:18236
	Trans. Am. Nucl. Soc., 45: 107-108(Oct 1983)			9:18237
	Trans. Am. Nucl. Soc., 45: 106-107(Oct 1983)			9:18238
	Trans. Am. Nucl. Soc., 45: 104-105(Oct 1983)			9:18239
	Trans. Am. Nucl. Soc., 45: 103(Oct 1983)			9:18240
	Trans. Am. Nucl. Soc., 45: 91(Oct 1983)			9:18241
	Trans. Am. Nucl. Soc., 45: 90(Oct 1983)			9:18242
	Trans. Am. Nucl. Soc., 45: 88-90(Oct 1983)			9:18243
	Trans. Am. Nucl. Soc., 45: 47-49(Oct 1983)			9:18244
	Trans. Am. Nucl. Soc., 45: 42-43(Oct 1983)			9:18245
	Trans. Am. Nucl. Soc., 45: 37(Oct 1983)			9:18246
	Trans. Am. Nucl. Soc., 45: 479(Oct 1983)			9:18627
	Trans. Am. Nucl. Soc., 45: 482-483(Oct 1983)			9:18628
	Trans. Am. Nucl. Soc., 45: 799(Oct 1983)			9:18905

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	Trans. Am. Nucl. Soc., 45: 793-794(Oct 1983)			9:18906
	Trans. Am. Nucl. Soc., 45: 217-218(Oct 1983)			9:18986
	Trans. Am. Nucl. Soc., 45: 705-707(Oct 1983)			9:19414
140	*See* EGG-M-12283	DE84008022	MN -70B	9:18168
CONF-8310168-	(HP 1000 international users group conference, Fort Worth, TX, USA, 18-21 Oct 1983)			
1	*See* UCRL-89132	DE84001844	MN -22	9:18109
CONF-8310175-	(36. annual Pacific Coast Regional meeting of the American Ceramic Society, San Diego, CA, USA, 3-5 Oct 1983)			
3	*See* HEDL-SA-2931	DE84006892	MN -79b	9:18456
CONF-8310227-	(Monopole '83 conference, Ann Arbor, MI, USA, 6-9 Oct 1983)			
5	*See* FERMILAB-Conf-83/107-THY	DE84007955	MN -34D	9:19427
7	*See* LBL-16846	DE84008236	MN -34D	9:19376
CONF-8310229-	(Chapman conference on magnetic reconnection, Los Alamos, NM, USA, 3-7 Oct 1983)			
10	*See* LA-UR-84-714	DE84007470	MN -20b	9:19562
CONF-8310259-	(EdCompCon conference, San Jose, CA, USA, 18 Oct 1983)			
1	*See* UCRL-90419	DE84007413	MN -32	9:19603
CONF-831106-	(Topical meeting on safeguards technology - the process safeguards interface, Hilton Head Island, SC, USA, 28 Nov-1 Dec 1983)			
	Trans. Am. Nucl. Soc., Suppl., 45: 1(Dec 1983)			9:18274
CONF-831112-	(Coal technology '83 - international coal utilization convention, Houston, TX, USA, 15-17 Nov 1983)			
4	Stone and Webster Engineering Corp., Boston, MA		MN -90f	9:18032
7	NTIS, PC A02/MF A01	DE84900876	MN -90i	9:18661
CONF-831174-	(Materials Research Society annual meeting, Boston, MA, USA, 14-17 Nov 1983)			
82	NTIS, PC A02; 3 (GPO Dep.)	DE84006717	MN -25	9:18789
83	*See* DP-MS-83-62	DE84008188	MN -70	9:18161
84	*See* PNL-SA-11771	DE84008340	MN -70	9:18181
CONF-831180-	(3. international symposium on the production and neutralization of negative ions and beams, Upton, NY, USA, 14-18 Nov 1983)			
23	*See* BNL-34235	DE84007378	MN -28	9:18948
25	*See* BNL-34239	DE84007377	MN -28	9:18949
26	*See* BNL-34268	DE84007391	MN -28	9:18939
27	*See* BNL-34242	DE84007392	MN -28	9:19251
CONF-8311101-	(12. CAM-I annual meeting and technical conference, Dallas, TX, USA, 8-10 Nov 1983)			
2	*See* BDX-613-2993	DE84008306	MN -38	9:18884
CONF-8311107-	(Society of Petroleum Engineers of AIME eastern regional meeting, Champion, PA, USA, 9-11 Nov 1983)			
	Soc. Pet. Eng. AIME, Pap., SPE 12322: 217-224(Nov 1983)			9:18074
	Soc. Pet. Eng. AIME, Pap., SPE 12304: 71-80(Nov 1983)			9:18083
CONF-8311140-	(Fractal structure in physics conference, Washington, DC, USA, 23-26 Nov 1983)			
1	*See* LA-UR-84-431	DE84007501	MN -34A	9:19263
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
106	*See* HEDL-SA-2927-FP	DE84006064	MN -79b	9:19537
119	*See* GA-A-17209	DE84009037	MN -20a	9:19527
120	*See* GA-A-17216	DE84009036	MN -20d	9:19531
121	*See* GA-A-17219	DE84009040	MN -20d	9:19534
122	*See* GA-A-17217	DE84009035	MN -20d	9:19532
123	*See* GA-A-17218	DE84009038	MN -20a	9:19533
125	*See* GA-A-17211	DE84009017	MN -20d	9:19528
126	*See* GA-A-17213	DE84009022	MN -20d	9:19529
127	*See* GA-A-17215	DE84009021	MN -20d	9:19530
CONF-831217-	(5. civilian radioactive waste management information meeting, Washington, DC, USA, 12-15 Dec 1983)			
26	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84005294	MN -70	9:18156
27	NTIS, PC A02; 3 (GPO Dep.)	DE84005295	MN -70	9:18157
CONF-831253-	(9. workshop on geothermal reservoir engineering, Stanford, CA, USA, 13-15 Dec 1983)			
10	*See* LBL-16672	DE84008253	MN -66a	9:18386
CONF-831256-	(6. international conference on computing methods in applied sciences and engineering, Paris, France, 12-16 Dec 1983)			
2	*See* LBL-17221	DE84008249	MN -92a	9:18048
CONF-831264-	(Workshop on accelerator physics issues for a superconducting super collider, Ann Arbor, MI, USA, 12-17 Dec 1983)			
9	*See* LBL-17020	DE84006767	MN -28	9:18947
11	*See* ANL-HEP-CP-84-04	DE84007302	MN -28	9:18944
CONF-831267-	(Workshop on supersymmetry in physics, Los Alamos, NM, USA, 15-20 Dec 1983)			
3	*See* SLAC-PUB-3280	DE84007803	MN -34D	9:19377
CONF-831269-	(Annual meeting of the Washington State Wildlife Society, Richland, WA, USA, 7 Dec 1983)			
2	*See* PNL-SA-11806	DE84006661	MN -11	9:19059
CONF-831272-	(EHV systems assessment seminar, Gainesville, FL, USA, 14-15 Dec 1983)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007274	MN -96	9:18729
2	*See* UCRL-90465	DE84008328	MN -94c	9:18633

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CONF-831273-	(Royal Swedish Academy of Engineering Sciences energy storage conference, Stockholm, Sweden, 12 Dec 1983)			
1	*See* LBL-17058	DE84008245	MN -94c	9:18631
CONF-840111-	(8. annual symposium on energy from biomass and wastes, Lake Buena Vista, FL, USA, 30 Jan-3 Feb 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007544	MN -61A	9:18337
3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007515	MN -61E	9:18317
4	NTIS, PC A03/MF A01	DE84900774	MN -61A	9:18318
5	*See* EGG-M-16883	DE84007666	MN -61F	9:18323
CONF-840112-	(IEEE Power Engineering Society winter meeting, Dallas, TX, USA, 29 Jan-3 Feb 1984)			
3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007518	MN -86	9:18119
CONF-840124-	(American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting, Atlanta, GA, USA, 29 Jan-1 Feb 1984)			
5	NTIS, PC A02; 3 (GPO Dep.)	DE84007537	MN -95d	9:18680
CONF-840142-	(International symposium on heavy ion accelerators and their applications to inertial fusion, Tokyo, Japan, 23-27 Jan 1984)			
4	*See* LA-UR-84-606	DE84007483	MN -21	9:19561
CONF-840148-	(3. international conference on baryon non-conservation, Park City, UT, USA, 1 Jan 1984)			
1	*See* LA-UR-84-644	DE84007465	MN -34D	9:19348
CONF-840201-	(ASME energy sources technology conference and exhibition, New Orleans, LA, USA, 12-16 Feb 1984)			
10	*See* SERI/TP-252-2149	DE84000086	STD -64	9:18370
CONF-840202-	(17. midyear topical meeting of the Health Physics Society, Pasco, WA, USA, 5-9 Feb 1984)			
16	*See* HEDL-SA-2969-FP	DE84007179	MN -79b	9:18115
17	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007557	MN -48	9:19051
18	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007562	MN -41	9:18972
19	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007519	MN -41	9:19067
20	NTIS, PC A02; 3 (GPO Dep.)	DE84007917	MN -11	9:19068
21	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007560	MN -41	9:19409
24	*See* PNL-SA-11548	DE84008321	MN -41	9:19078
CONF-840218-	(113. annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers, Los Angeles, CA, USA, 26 Feb-2 Mar 1984)			
3	*See* PNL-SA-11818	DE84008323	MN -70	9:18183
5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007539	MN -25	9:18738
CONF-840238-	(Cooling Tower Institute annual technical meeting, Houston, TX, USA, 6-8 Feb 1984)			
1	*See* K/PS-5026	DE84007960	MN -12	9:18927
CONF-840245-	(6. symposium on management of uranium mill tailings, low-level waste, and hazardous waste, Fort Collins, CO, USA, 1-3 Feb 1984)			
7	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007517	MN -70A	9:18251
8	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007522	MN -70B	9:18158
9	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007521	MN -70A	9:18252
10	*See* PNL-SA-11805	DE84008339	MN -70A	9:18182
11	*See* PNL-SA-11680	DE84008302	MN -70A	9:18180
CONF-840255-	(6. US-Japan symposium on compact toroid research, Princeton, NJ, USA, 20-23 Feb 1984)			
1	*See* LA-UR-84-601	DE84007488	MN -20f	9:19504
2	*See* LA-UR-84-602	DE84007489	MN -20f	9:19559
3	*See* LA-UR-84-603	DE84007476	MN -20f	9:19560
6	*See* LA-UR-84-583	DE84007487	MN -20f	9:19502
7	*See* LA-UR-84-584	DE84007482	MN -20f	9:19503
CONF-840256-	(Chapman conference on collisionless shock waves in the heliosphere, Napa Valley, CA, USA, 20-24 Feb 1984)			
1	*See* LA-UR-84-512	DE84007500	MN -34B	9:19249
CONF-840257-	(DOE nuclear reactor and facility safety conference, Rockville, MD, USA, 27-29 Feb 1984)			
1	*See* K/P-6791	DE84007473	MN -41	9:19221
2	*See* DP-MS-83-143	DE84008173	MN -2	9:18120
4	*See* DP-MS-84-23	DE84009075	MN -80	9:18493
CONF-840258-	(Materials Research Society spring meeting, Albuquerque, NM, USA, 27-29 Feb 1984)			
1	*See* SAND-84-1074C	DE84008035	MN -63	9:18358
2	*See* SAND-83-1958C	DE84008028	MN -25	9:18808
3	*See* SAND-83-1954C	DE84008334	MN -25	9:18778
CONF-840260-	(Annual joint APS/AAPT meeting, San Antonio, TX, USA, 2 Feb 1984)			
1	*See* FERMILAB-Conf-84/27	DE84007249	MN -34	9:19232
CONF-840261-	(24. annual regional symposium of the Twin City Section of the AIChE, St. Paul, MN, USA, 16 Feb 1984)			
1	*See* DOE/FE/60181-51	DE84007409	MN -90	9:17941
CONF-840262-	(International conference on deposits and corrosion in industrial and utility combustion systems, Essen, F.R. Germany, 29 Feb-1 Mar 1984)			
1	*See* DOE/FE/60181-29	DE84007411	MN -90	9:18033
CONF-840263-	(Workshop on samples environments in neutron and x-ray experiments, Grenoble, France, 13-15 Feb 1984)			
1-Draft	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007541	MN -34C	9:18739
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007269	MN -28	9:18950

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CONF-840264-	(Workshop on high energy excitations in condensed matter, Los Alamos, CA, USA, 13-15 Feb 1984)			
1-Draft	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007540	MN -34C	9:19465
CONF-840267-	(13. annual symposium on applied vacuum science and technology, Clearwater Beach, FL, USA, 6-8 Feb 1984)			
1	*See* DP-MS-83-115	DE84008288	MN -4	9:18790
CONF-840269-	(NADAP Task Group G peer review meeting, Burlington, VT, USA, 14-17 Feb 1984)			
5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007602	MN -11	9:19060
CONF-840304-	(35. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, Atlantic City, NJ, USA, 5-10 Mar 1984)			
1	*See* DP-MS-83-82	DE84008187	MN -4	9:18820
CONF-840307-	(Waste management '84, Tucson, AZ, USA, 11-15 Mar 1984)			
1-Rev.1	*See* UCRL-89820-Rev.1	DE84007405	MN -70	9:18189
4	*See* SAND-83-2042C	DE84008029	MN -70	9:18256
5	*See* SAND-84-0415C	DE84008030	MN -70	9:18766
6	*See* SAND-84-0035C	DE84008033	MN -70	9:18264
7	*See* SAND-83-2044C	DE84008032	MN -70	9:18257
8	*See* UCRL-89869	DE84007779	MN -85	9:18258
9	*See* UCRL-89830	DE84007791	MN -70	9:18190
10	*See* DP-MS-84-8	DE84008178	MN -70	9:18164
11	*See* SAND-83-2550C	DE84008332	MN -71	9:18133
12	*See* DP-MS-83-111	DE84008286	MN -70	9:18163
13	*See* SAND-84-0515C	DE84008333	MN -71	9:18904
14	*See* SAND-83-2043C	DE84009093	MN -70	9:18188
15	*See* SAND-84-0571C	DE84009094	MN -70	9:18135
16	*See* DP-MS-83-86	DE84009077	MN -70B	9:18162
17	*See* SAND-84-0516C	DE84009068	MN -70	9:18134
18	*See* DP-MS-84-19	DE84009076	MN -86	9:18166
19	*See* DP-MS-84-11	DE84009073	MN -86	9:18165
CONF-840386-	(9. US TRIGA owner-user conference, Anaheim, CA, USA, 12 Mar 1984)			
1	*See* HEDL-SA-3078-FP	DE84007172	MN -80	9:18491
CONF-840387-	(2. topical meeting on laser techniques in the extreme ultraviolet, Boulder, CO, USA, 5-7 Mar 1984)			
1	*See* LA-UR-84-720	DE84007479	MN -25	9:18994
CONF-840389-	(US-Japan information exchange seminar on photochemical energy solar conversion, Okazaki, Japan, 12-15 Mar 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007278	MN -61G	9:18338
2	*See* BNL-34397	DE84008184	MN -61G	9:18336
3	*See* LBL-17368	DE84009213	MN -61G	9:18302
CONF-840390-	(Vehicle propulsion symposium, Indianapolis, IN, USA, 20-22 Mar 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007275	MN -96	9:18730
CONF-840392-	(DOE/ANL training course on prevention of significant nuclear events, Augusta, GA, USA, 12-15 Mar 1984)			
1	*See* DP-MS-83-142	DE84008185	MN -41	9:18261
2	*See* K/HS-26	DE84007576	MN -41	9:18262
3	*See* K-DSA-991	DE84007472	MN -41	9:18107
4	*See* K/P-6790	DE84008007	MN -41	9:18108
CONF-840405-	(NACE corrosion '84 international forum and exhibition, New Orleans, LA, USA, 1-6 Apr 1984)			
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84005412	MN -90c	9:17934
CONF-840415-	(187. national meeting of the American Chemical Society, St. Louis, MO, USA, 8-13 Apr 1984)			
16	*See* BNL-34087	DE84008175	MN -90	9:17932
CONF-840427-	(Topical meeting on financial and economic bases for nuclear power, Washington, DC, USA, 8-11 Apr 1984)			
1	*See* SAND-84-0067C	DE84007245	MN -78	9:18625
CONF-840448-	(65. annual American Welding Society convention, Dallas, TX, USA, 9-13 Apr 1984)			
3	*See* DP-MS-83-83	DE84008186	MN -23	9:18299
CONF-840489-	(Gas-liquid chemistry of natural waters conference, Upton, NY, USA, 1-6 Apr 1984)			
1	*See* BNL-34474	DE84007694	MN -4	9:18867
CONF-840494-	(Topical meeting on optical fabrication and testing, Monterey, CA, USA, 18-20 Apr 1984)			
4	*See* UCRL-90138	DE84007783	MN -25	9:18735
5	*See* BNL-34250	DE84007376	MN -34C	9:19447
CONF-8404105-	(North Dakota Academy of Science conference, Fargo, ND, USA, 26-28 Apr 1984)			
1	*See* DOE/FE/60181-59	DE84006377	MN -90d	9:17943
CONF-8404108-	(Chromatography spring symposium, Minneapolis, MN, USA, 16-17 Apr 1984)			
1	*See* DOE/FE/60181-56	DE84006382	MN -90d	9:17942
CONF-8404109-	(IEEE symposium on security and privacy, Oakland, CA, USA, 30 Apr-2 May 1984)			
1	*See* LA-UR-84-650	DE84007468	MN -32	9:19594
CONF-8404110-	(4. international conference on high temperature science - HYTHERM, Santa Fe, NM, USA, 2-6 Apr 1984)			
1	*See* LA-UR-84-711	DE84007469	MN -4	9:18827
2	*See* SAND-83-2444C	DE84007887	MN -4	9:18864

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-840529-	(Linear accelerator conference, Darmstadt-Seeheim, F.R. Germany, 7-11 May 1984)			
2	*See* LA-UR-84-200	DE84006023	MN -15	9:18173
CONF-8405120-	(SPE/DOE/GRI gas recovery symposium, Pittsburgh, PA, USA, 13-15 May 1984)			
3	*See* SAND-84-0554C	DE84008294	MN -92a	9:18073
CONF-840612-	(Air Pollution Control Association annual meeting, San Francisco, CA, USA, 25-28 Jun 1984)			
1	*See* DOE/FE/60181-31	DE84008163	MN -90i	9:17979
CONF-840701-	(Topical meeting on fission product behavior and source term research, Snowbird, UT, USA, 15-19 Jul 1984)			
9	*See* HEDL-SA-3074-S	DE84008346	MN -79p	9:18512
CONF-841201-	(ASME winter annual meeting, New Orleans, LA, USA, 9-13 Dec 1984)			
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006364	MN -79	9:18920
COO-				
2383-0103	*See* UIUCDCS-R-83-1155	DE84008193	MN -32	9:19600
CSIRO-DAG-GCM-				
42	Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Victoria, Australia			9:18002
46	Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Victoria, Australia			9:18003
47	Commonwealth Scientific and Industrial Research Organisation, Div. of Applied Geomechanics, Mount Waverley, Victoria, Australia			9:18004
CTA-EAV-NT-				
013/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84700698	MN -34C	9:19426
DESY-				
83-042	NTIS (US Sales Only), PC A04/MF A01	DE84750247	MN -34D	9:19278
83-043	NTIS (US Sales Only), PC A03/MF A01	DE84750246	MN -34D	9:19303
83-044	NTIS (US Sales Only), PC A02/MF A01	DE84750245	MN -34D	9:19304
83-049	NTIS (US Sales Only), PC A02/MF A01	DE84750248	MN -34D	9:19279
83-058	NTIS (US Sales Only), PC A02/MF A01	DE84750249	MN -28	9:18951
83-059	NTIS (US Sales Only), PC A03/MF A01	DE84750250	MN -34D	9:19280
83-060	NTIS (US Sales Only), PC A03/MF A01	DE84750251	MN -34D	9:19305
83-061	NTIS (US Sales Only), PC A05/MF A01	DE84750869	MN -34D	9:19306
83-062	NTIS (US Sales Only), PC A04/MF A01	DE84750890	MN -28	9:18959
83-063	NTIS (US Sales Only), PC A02/MF A01	DE84750506	MN -34D	9:19281
83-064	NTIS (US Sales Only), PC A02/MF A01	DE84750507	MN -34D	9:19282
83-065	NTIS (US Sales Only), PC A02/MF A01	DE84750252	MN -28	9:18960
83-066	NTIS (US Sales Only), PC A02/MF A01	DE84750505	MN -34D	9:19283
83-067	NTIS (US Sales Only), PC A02/MF A01	DE84750253	MN -34D	9:19284
83-068	NTIS (US Sales Only), PC A10/MF A01	DE84750867	MN -34D	9:19307
83-069	NTIS (US Sales Only), PC A03/MF A01	DE84750254	MN -34D	9:19365
83-070	NTIS (US Sales Only), PC A04/MF A01	DE84750865	MN -34D	9:19308
83-071	NTIS (US Sales Only), PC A02/MF A01	DE84750866	MN -34D	9:19285
83-072	NTIS (US Sales Only), PC A02/MF A01	DE84750868	MN -34D	9:19309
83-073	NTIS (US Sales Only), PC A02/MF A01	DE84750899	MN -28	9:18946
83-074	NTIS (US Sales Only), PC A02/MF A01	DE84750870	MN -34D	9:19366
83-075	NTIS (US Sales Only), PC A02/MF A01	DE84750733	MN -34D	9:19353
83-076	NTIS (US Sales Only), PC A03/MF A01	DE84750891	MN -34D	9:19286
83-077	NTIS (US Sales Only), PC A02/MF A01	DE84750887	MN -34D	9:19367
83-078	NTIS (US Sales Only), PC A02/MF A01	DE84750888	MN -34D	9:19310
83-079	NTIS (US Sales Only), PC A02/MF A01	DE84750889	MN -34D	9:19287
83-081	NTIS (US Sales Only), PC A03/MF A01	DE84750900	MN -34D	9:19288
83-082	NTIS (US Sales Only), PC A02/MF A01	DE84750881	MN -34D	9:19368
83-084	NTIS (US Sales Only), PC A02/MF A01	DE84750902	MN -34D	9:19289
83-085	NTIS (US Sales Only), PC A03/MF A01	DE84750901	MN -34D	9:19290
83-086	NTIS (US Sales Only), PC A03/MF A01	DE84750903	MN -34D	9:19369
83-090	NTIS (US Sales Only), PC A07/MF A01	DE84750905	MN -34D	9:19311
83-091	NTIS (US Sales Only), PC A03/MF A01	DE84750904	MN -34D	9:19370
83-092	NTIS (US Sales Only), PC A02/MF A01	DE84750896	MN -34C	9:19312
83-093	NTIS (US Sales Only), PC A02/MF A01	DE84750897	MN -34D	9:19313
83-094	NTIS (US Sales Only), PC A02/MF A01	DE84750898	MN -34D	9:19314
DESY-L-Trans-				
279	NTIS (US Sales Only), PC A02/MF A01	DE84750513	MN -34D	9:19474
280	NTIS (US Sales Only), PC A05/MF A01	DE84750512	MN -34D	9:19371
281	Deutsches Elektronen-Synchrotron Hamburg (Germany, F.R.)			9:19315
DOE/AD/11261-				
T1	NTIS, PC A06/MF A01 (GPO Dep.)	DE84005711	MN -95	9:18725
DOE/AL/10563-				
T18	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008264	STD -66a	9:18391
DOE/APC-				
84/ 1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007993	STD -11	9:19025
DOE/BC/10412-				
44	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84007939	STD -92a	9:18045
DOE/BETC/QPR-				
83/ 3	NTIS, PC A04/MF A01; 1	DE84009081	STD -92a	9:18046
DOE/CE-				
0015/ 2	NTIS, PC A05/MF A01 (GPO Dep.)	DE84007941	MN -95	9:18704
0033/ 2	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84009179	STD -63	9:18339
0076	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009106	STD -98	9:18663

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DOE/CE/15095-9	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007877	STD -95	9:18681
DOE/CE/15130-T4	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84009175	STD -88	9:18005
DOE/CE/30744-1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84006725	STD -59a	9:18372
DOE/CE/77011-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84010264	STD -66	9:18377
DOE/CH/10095-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84006731	MN -13	9:18677
DOE/CS/15038-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007417	MN -95d	9:18682
DOE/CS/20071-1-Vol.4	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84006861	STD -95d	9:18717
1-Vol.7-App.C	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84006862	STD -95d	9:18718
DOE/CS/20291-T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007873	MN -95e	9:18719
T3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007872	MN -95e	9:18720
T4	NTIS, PC A06; 3 (GPO Dep.)	DE84007868	MN -95e	9:18721
T5	NTIS, PC A04/MF A01 (GPO Dep.)	DE84007874	MN -95e	9:18722
DOE/CS/20542-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84007305	MN -98B	9:18662
DOE/CS/22046-T1-Vol.1	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84008192	MN -95d	9:18683
T1-Vol.2	NTIS, PC A16/MF A01 (GPO Dep.)	DE84008190	MN -95d	9:18684
T1-Vol.3	NTIS, PC A15/MF A01 (GPO Dep.)	DE84008191	MN -95d	9:18685
DOE/CS/22053-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007863	MN -95d	9:18686
DOE/CS/40005-T5	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84007475	MN -95e	9:18705
DOE/CS/40028-T2	NTIS, PC A04/MF A01 (GPO Dep.)	DE83014729	STD -95f	9:18706
DOE/CS/40338-4	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009104	STD -92b	9:18057
DOE/CS/54273-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84004663	MN -96	9:18731
DOE/CS/65004-T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007904	MN -95c	9:18655
DOE/CS/83100-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84005338	MN -63	9:18340
DOE/CS/83105-2	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84008215	MN -63e	9:18341
DOE/CS/84004-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007321	MN -61A	9:18307
DOE/DP/00789-T92	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006886	MN -62b	9:18366
T93	NTIS, PC A03/MF A01 (GPO Dep.)	DE84006887	MN -62b	9:18367
DOE/DP/40124-20	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008336	MN -21	9:19488
DOE/EI/10085-T6	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84002245	MN -98	9:18668
DOE/EI/10577-T3	NTIS, PC A07/MF A01 (GPO Dep.)	DE84007306	MN -88	9:18006
DOE/EI/11896-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007940	MN -13	9:19576
DOE/EIA-0173(83)	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	DE84007697	MN -98	9:18634
0226(83/ 12)	NTIS, PC A03/MF A01 - GPO (GPO Dep.)	DE84008337	MN -98E	9:18664
0380(83/ 12[3])	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	DE84008263	MN -98B	9:18051
0409	NTIS, PC A06/MF A01 (GPO Dep.)	DE84007585	MN -98F	9:18653
0436(83)	NTIS, PC A04/MF A01 - GPO (GPO Dep.)	DE84001799	MN -98	9:18648
DOE/EIS-0107-D	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84007287	MN -97a	9:19125
DOE/EP-0040/ 2	NTIS, PC A04/MF A01 (GPO Dep.)	DE84007946	STD -41	9:19173
DOE/ER-0177	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007667	MN -11	9:19094
DOE/ER/00038-2517	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007396	MN -4	9:18868
2537	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009058	MN -4	9:18869
DOE/ER/01545-344	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009060	MN -34D	9:19372
DOE/ER/04222-5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007963	MN -4	9:18308
DOE/ER/04445-T3	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84008204	MN -94cc	9:18859
DOE/ER/04900-4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009059	MN -4	9:18840
DOE/ER/04946-5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008222	MN -4	9:18300
DOE/ER/05002-39	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007889	MN -25	9:18818
DOE/ER/05528-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007214	MN -61G	9:18301

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DOE/ER/10418-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008384	MN -37	9:18973
DOE/ER/10528-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007691	MN -34D	9:19316
DOE/ER/10534-3	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009099	MN -4	9:18342
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009097	MN -4	9:18343
T2	NTIS, PC A10/MF A01 (GPO Dep.)	DE84009096	MN -63e	9:18344
DOE/ER/10539-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84008219	MN -63e	9:18345
DOE/ER/10545-1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84006882	MN -61	9:18862
DOE/ER/10550-6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009102	MN -28	9:18974
DOE/ER/10646-3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009057	MN -96	9:18727
DOE/ER/10655-5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007290	MN -4	9:18780
T1	NTIS, PC A06/MF A01 (GPO Dep.)	DE84007568	MN -4	9:18781
DOE/ER/10677-7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008276	MN -4	9:18882
DOE/ER/10981-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009373	MN -4	9:18841
DOE/ER/12001-T1	NTIS, PC A06/MF A01 (GPO Dep.)	DE84008252	MN -32	9:19480
DOE/ER/13020-1	Academic Press, Inc., 111 Fifth Ave., New York, NY 10003		ND -32	9:19271
DOE/ER/13112-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008257	MN -11	9:19231
DOE/ER/40071-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009089	MN -34D	9:19253
DOE/ER/45045-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007464	MN -38	9:18779
DOE/ER/52065-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007425	MN -96	9:18732
DOE/ER/60186-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009145	MN -11	9:19052
DOE/ER/80101-1	NTIS, PC A05/MF A01 (GPO Dep.)	DE84008225	MN -20a	9:19526
DOE/ET/00082-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008235	MN -61G	9:18842
DOE/ET/10069-T82	NTIS (US Sales Only), PC A03/MF A01 (GPO Dep.)	DE84007767	STD -90d	9:17935
T83	NTIS (US Sales Only), PC A10/MF A01; 1 (GPO Dep.)	DE84007771	STD -90d	9:17936
T84	NTIS (US Sales Only), PC A02/MF A01; 1 (GPO Dep.)	DE84007880	MN -90d	9:17937
T85	NTIS (US Sales Only), PC A10/MF A01; 1 (GPO Dep.)	DE84008043	STD -90d	9:17938
DOE/ET/10393-1528	NTIS, PC A03/MF A01 (GPO Dep.)	DE84003058	STD -90e	9:18934
DOE/ET/10532-T16	NTIS, PC A04/MF A01 (GPO Dep.)	DE84007586	STD -90d	9:17939
DOE/ET/10735-T2	NTIS, PC A04/MF A01 (GPO Dep.)	DE84006446	MN -90d	9:17940
DOE/ET/11273-T1	NTIS MF A01; 2	DE84004722	STD -90i	9:17976
DOE/ET/11289-T7	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009360	STD -90f	9:18895
DOE/ET/14167-T1	NTIS, PC A03/MF A01; 1	DE83017126	MN -91	9:18089
DOE/ET/15492-T47	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009053	MN -90i	9:17977
DOE/ET/20004-T2	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009122	MN -61A	9:18346
DOE/ET/20422-3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84006572	MN -62c	9:18368
DOE/ET/27014-T7	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007662	MN -66	9:18384
DOE/ET/27163-T4	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007769	STD -66f	9:18390
DOE/ET/34034-93	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007958	MN -77	9:18449
DOE/ET/51013-113	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007976	MN -20a	9:19489
DOE/ET/53088-128	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008272	MN -20f	9:19490
DOE/EV/00641-49	NTIS, PC A05/MF A01 (GPO Dep.)	DE84001775	MN -11	9:19069
DOE/EV/04580-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007950	MN -11	9:19200
DOE/EV/04703-44	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008354	MN -34A	9:19254
DOE/EV/04946-6-App.3	NTIS, PC A05/MF A01; 1	DE84001250	MN -88	9:18007
DOE/EV/10315-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007418	MN -88	9:18008

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DOE/EV/70007-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006020	MN -48	9:19139
DOE/FE-0036	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007802	STD -92	9:18062
0037	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007763	MN -92	9:18063
DOE/FE/60088-T1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84008320	STD -90i	9:17978
DOE/FE/60181-29	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007411	MN -90	9:18033
31	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008163	MN -90i	9:17979
51	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007409	MN -90	9:17941
56	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006382	MN -90d	9:17942
59	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006377	MN -90d	9:17943
DOE/FE/60338-6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007814	MN -93	9:18673
DOE/FE/60339-2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84005719	STD -90e	9:17917
DOE/ID/12063-T1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009369	MN -66b	9:18385
DOE/ID/12122-1	NTIS, PC A04/MF A01 (GPO Dep.)	DE84007793	STD -97e	9:18329
DOE/ID/12439-T1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008196	MN -95f	9:18707
DOE/IE-0001	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007764	MN -97	9:18412
0002	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84008167	MN -92	9:18052
DOE/IG-0203	USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830		STD -13	9:18635
0204	USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830 (GPO Dep.)		STD -92	9:18064
DOE/JPL/955909-83/ 11	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84004366	STD -63b	9:18347
DOE/JPL/956312-06	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009044	STD -63b	9:18348
DOE/JPL/956369-83	NTIS, PC A03/MF A01; 1	DE84002416	STD -63b	9:18349
DOE/JPL/956615-84-1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009178	STD -63b	9:18350
DOE/JPL/956698-84/ 1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009314	STD -63b	9:18351
DOE/LLW-18T-Rev.3	NTIS, PC A22/MF A01 (GPO Dep.)	DE84007326	STD -70B	9:18159
24T	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007532	STD -70B	9:18253
DOE/MA-0106/ 1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009107	MN -13	9:19577
DOE/MC/19330-1393	NTIS, PC A05/MF A01; 1	DE83008081	STD -90e	9:18935
DOE/METC/SP-199	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84003055	STD -90	9:17944
DOE/NASA/0030-80/ 4	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84009069	MN -93	9:18400
DOE/NASA/0241-12	NTIS, PC A07; 3 (GPO Dep.)	DE84006738	MN -93	9:18674
DOE/NASA/0291-1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84007582	STD -93	9:18675
DOE/NBB-0008	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84007668	MN -90i	9:18040
DOE/NBM-4004242	Resources for the Future Inc., 1755 Massachusetts Ave., N.W., Washington, DC		ND -98B	9:18056
4005437	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84005437	MN -38	9:18885
4007547	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007547	MN -80	9:18488
4009195	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009195	MN -93	9:18671
DOE/NDC-32	*See* INDC(USA)-92/G	DE84008015	MN -25	9:18275
DOE/NV/10058-1	NTIS, PC A07; 3 (GPO Dep.)	DE84000511	MN -70	9:19222
DOE/NV/10249-7	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009177	MN -92a	9:18066
T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008234	MN -92a	9:18067
T3	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009165	MN -92a	9:18068
T4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009166	MN -92a	9:18069
T5	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008233	MN -92a	9:18070
DOE/NV/10250-13	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009379	MN -70	9:18160
DOE/OR/05784-6	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008270	MN -4	9:19255
DOE/PC/30013-T5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007965	STD -90a	9:17970
DOE/PC/30075-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007714	MN -90d	9:17945
DOE/PC/30145-T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84007770	STD -90a	9:17971
DOE/PC/30185-T3	NTIS, PC A09/MF A01	DE84002140	STD -90e	9:18034

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DOE/PC/30214-T7	NTIS, PC A09/MF A01; 1	DE84004615	STD -90e	9:18936
DOE/PC/30232-T8	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007313	STD -90i	9:17980
DOE/PC/30246-1557	NTIS, PC A09/MF A01 (GPO Dep.)	DE84003089	STD -90i	9:17988
DOE/PC/30301-11	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84007869	STD -90a	9:18035
DOE/PC/40009-T7	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007330	STD -90d	9:17946
DOE/PC/40771-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007421	MN -90d	9:18309
DOE/PC/40789-T9	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007383	MN -90a	9:17972
DOE/PC/40799-T8	NTIS, PC A02/MF A01 (GPO Dep.)	DE84002134	MN -90d	9:17947
DOE/PC/40810-8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007393	STD -90d	9:17948
DOE/PC/50041-30	NTIS, PC A06/MF A01 (GPO Dep.)	DE84008341	STD -90d	9:17949
31	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84007882	STD -90d	9:17950
DOE/PC/50804-5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009046	STD -90a	9:18310
DOE/PC/60048-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84006704	STD -90d	9:17951
DOE/PC/60054-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007394	MN -90d	9:17952
DOE/PC/60262-T1	NTIS, PC A02; 3 (GPO Dep.)	DE84006833	MN -90a	9:17981
T2	NTIS, PC A02; 3 (GPO Dep.)	DE84007333	MN -90a	9:17982
DOE/PC/60265-T1	NTIS, PC A02/MF A01	DE84008265	MN -90a	9:18408
DOE/PC/60807-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007364	STD -90a	9:18819
DOE/PC/61256-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007529	MN -90d	9:17953
DOE/PE-0048	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009964	MN -41	9:18640
DOE/PE/70455-T1	NTIS, PC A09; 3 (GPO Dep.)	DE84007700	MN -92	9:18053
DOE/PETC/TR-84/ 4	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007768	STD -90i	9:18319
84/ 5	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007876	STD -90d	9:18311
84/ 6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84009209	STD -90b	9:18024
DOE/R4/10193-T4	NTIS, PC A10/MF A01 (GPO Dep.)	DE84005853	MN -92a	9:18079
DOE/R5/10302-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007348	MN -95e	9:18687
DOE/R7/01008-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84007758	MN -61E	9:18312
DOE/R7/01023-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007747	MN -61F	9:18324
DOE/R7/01029-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007745	MN -95d	9:18688
DOE/R7/01034-T1	NTIS, PC A02; 3 (GPO Dep.)	DE84007743	MN -95d	9:18708
DOE/R7/01035-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007740	MN -95	9:18726
DOE/R7/01041-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84007736	MN -61	9:18320
DOE/R7/01100-T1	NTIS, PC A02; 3 (GPO Dep.)	DE84007731	MN -66g	9:18689
DOE/R7/01119-T1	NTIS, PC A03; 3 (GPO Dep.)	DE84007719	MN -61	9:18321
DOE/R7/01121-T1	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007720	MN -61E	9:18322
DOE/R7/01125-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84007713	MN -95	9:18723
DOE/RA/04934-T34	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE84008267	STD -97e	9:18331
DOE/RG/08683-T8	NTIS, PC A24/MF A01; 1 (GPO Dep.)	DE84006371	MN -98E	9:18656
T9	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84006376	MN -98E	9:18657
T10	NTIS, PC A03/MF A01 (GPO Dep.)	DE84006369	MN -98E	9:18658
DOE/SF/00012-T24	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007322	MN -48	9:19149
DOE/SF/00515-T27	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007675	MN -28	9:18952
DOE/SF/11445-2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84007796	STD -92a	9:18047
DOE/SR/00870-33	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007516	MN -48	9:19166
34	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007867	MN -48	9:19058
35	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008197	MN -48	9:19167
36	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008177	MN -48	9:19168

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37	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008198	MN -48	9:19169
38	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008199	MN -48	9:19170
39	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007879	MN -48	9:19171
DOE/TIC-				
84/ 4/ EM	NTIS- $5.00		ND -13	9:19578
DP-				
1668	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007800	MN -11	9:19053
DP-MS-				
83-62	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008188	MN -70	9:18161
83-82	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008187	MN -4	9:18820
83-83	NTIS, PC A02/MF A01	DE84008186	MN -23	9:18299
83-86	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009077	MN -70B	9:18162
83-111	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008286	MN -70	9:18163
83-115	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008288	MN -4	9:18790
83-142	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008185	MN -41	9:18261
83-143	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008173	MN -2	9:18120
84-8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008178	MN -70	9:18164
84-11	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009073	MN -86	9:18165
84-19	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009076	MN -86	9:18166
84-23	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009075	MN -80	9:18493
DP-tr-				
61	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007462	MN -4	9:18110
DPST-				
59-202	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84005572	MN -4	9:18494
80-539	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009074	MN -80	9:18495
83-288	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008291	MN -70	9:18167
83-829-Vol.2	NTIS, PC A07/MF A01 (GPO Dep.)	DE84008171	MN -11	9:19108
DREO-TN-				
82-32	*See* AD-A-136625/1			9:19458
DTNSRDC/PAS-				
81/ 18	*See* AD-A-135339/0			9:18892
ECN-				
83-155	Stichting Energieonderzoek Centrum Nederland (ECN), P.O. Box 1, NL-1755 ZG, Petten			9:17973
83-166	Stichting Energieonderzoek Centrum Nederland (ECN), Petten			9:17954
83-172	Stichting Energieonderzoek Centrum Nederland (ECN), Petten			9:17974
EFI-				
564(51) -82	NTIS (US Sales Only), PC A02/MF A01	DE84700694	MN -34C	9:19448
569(56) -82	NTIS (US Sales Only), PC A02/MF A01	DE84700679	MN -34D	9:19373
570(57) -82	NTIS (US Sales Only), PC A02/MF A01	DE84700680	MN -34D	9:19354
576(63) -82	NTIS (US Sales Only), PC A03/MF A01	DE84700688	MN -34D	9:19291
581(68) -82	NTIS (US Sales Only), PC A02/MF A01	DE84700681	MN -34D	9:19317
EGG-				
2272	*See* NUREG/CR-3461	DE84005826	MN -80	9:18483
10282-2015	*See* LA-UR-84-200	DE84006023	MN -15	9:18173
EGG-M-				
12283	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008022	MN -70B	9:18168
16883	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007666	MN -61F	9:18323
EGG-SE-				
6442	NTIS, PC A07/MF A01 (GPO Dep.)	DE84007685	MN -93	9:18676
EGG-TFBP-				
6399-Rev.1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008020	MN -78	9:18509
EIR-				
490	NTIS (US Sales Only), PC A03/MF A01	DE84750496	MN -32	9:19590
EIS-				
4900249	US Dept. of the Interior, Minerals Management Service, 18th and C Sts., NW, Washington, DC 20240		MN -11	9:19126
ENICO-				
1137	*See* NUREG/CR-3512	DE84007352	MN -41	9:19075
EPA-				
450/ 3-84-004	NTIS, PC A06/MF A01; 1		MN -11	9:19057
450/ 4-83-016	*See* PB-83-239830			9:19033
520/ 5-83-020	*See* PB-84-119932			9:18982
600/ 4-83-040	*See* PB-84-126929			9:19065
600/ 7-83-058	*See* PB-84-122837			9:19034
600/ D-84-004	*See* PB-84-124999			9:19063
600/ D-84-006	*See* PB-84-129386			9:18643
600/ D-84-025	*See* PB-84-130418			9:19038
600/ D-84-027	*See* PB-84-130483			9:18092
910/ 9-83/ 104A	*See* PB-84-135789			9:19066
EPRI-EA-				
3072	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -11	9:19026
3075	Electric Power Research Institute, 3412 Hillview Ave, Palo Alto, CA 94304		ND -11	9:19027
3077	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -12	9:19028
3221-Vol.1	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -11	9:19082
3292	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -11	9:19029

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EPRI-EL-				
3295	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -97a	9:18413
3306	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -97a	9:18414
EPRI-EM-				
3371	Electric Power Research Institute, 3412 Hillview Ave., Palo Alto, CA 94304		ND -95d	9:18690
EQL-				
19	NTIS, PC A09/MF A01 (GPO Dep.)	DE84006914	MN -90	9:17955
ESC-				
24	Stichting Energieonderzoek Centrum Nederland (ECN), Energie Studie Centrum, Petten, Netherlands			9:18650
26	Stichting Energieonderzoek Centrum Nederland (ECN), Energie Studie Centrum, Petten			9:18401
ESC-WR-				
83-22	Stichting Energieonderzoek Centrum Nederland (ECN), Energie Studie Centrum, Petten			9:18402
EUR-				
7775-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18009
7776-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18010
7888-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17967
7963-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17975
7988e	*See* KFK-3593	DE84750886	MN -38	9:18928
8126-FR	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17956
8189-FR	*See* PB-84-135318			9:19183
8249-FR	*See* PB-84-138924			9:18763
8321	*See* PB-84-138908			9:18381
8329-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17983
8374-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18011
8376-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18012
8377-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18025
8378-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18013
8384-FR	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17957
8385-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17968
8386-FR	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17984
8387-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17958
8388-FR	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17985
8389-FR	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:17959
8430-DE	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18014
8432-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18015
8433-EN	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			9:18016
8541	NTIS PC E05/MF E05			9:18379
FE-				
2315-99	*See* DOE/ET/10532-T16	DE84007586	STD -90d	9:17939
2893-112	*See* DOE/ET/10069-T85	DE84008043	STD -90d	9:17938
2893-121	*See* DOE/ET/10069-T83	DE84007771	STD -90d	9:17936
2893-126	*See* DOE/ET/10069-T84	DE84007880	MN -90d	9:17937
2893-127	*See* DOE/ET/10069-T82	DE84007767	STD -90d	9:17935
FEI-				
1327	NTIS (US Sales Only), PC A02/MF A01	DE84700116	MN -38	9:18922
1361	NTIS (US Sales Only), PC A02/MF A01	DE84700117	MN -38	9:18923
1374	NTIS (US Sales Only), PC A02/MF A01	DE84700118	MN -38	9:18924
1377	NTIS (US Sales Only), PC A02/MF A01	DE84700119	MN -38	9:18925
1379	NTIS (US Sales Only), PC A02/MF A01	DE84700120	MN -38	9:18926
FERC/EIS-				
0010	NTIS, PC A14; 3 (GPO Dep.)	DE84006841	MN -97e	9:19127
0017	NTIS, PC A22/MF A01; 1 (GPO Dep.)	DE84009438	MN -97e	9:18332
0020	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE84009433	MN -11	9:19128
FERMILAB-Conf-				
83/ 107-THY	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007955	MN -34D	9:19427
84/ 22-E	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007247	MN -37	9:18975
84/ 23-E	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007248	MN -37	9:18976
84/ 27	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007249	MN -34	9:19232
FOA-C-				
20514-T1	*See* PB-84-124056			9:19022

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20517-A3	*See* PB-84-129907			9:19020
FWS/OBS-				
82/ 11.5	National Coastal Ecosystems Team, US Dept. of Interior Fish and Wildlife Service, Washington, DC 20240		MN -11	9:19083
82/ 11.9	National Coastal Ecosystems Team, US Dept. of the Interior Fish and Wildlife Service, Washington, DC 20240		MN -11	9:19084
82/ 11-10	National Coastal Ecosystems Team, US Dept. of Interior Fish and Wildlife Service, Washington, DC 20240		MN -11	9:19085
82/ 11.14	National Coastal Ecosystems Team, US Dept. of Interior Fish and Wildlife Service, Washington, DC 20240		MN -11	9:19086
GA-A-				
17209	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009037	MN -20a	9:19527
17211	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009017	MN -20d	9:19528
17213	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009022	MN -20d	9:19529
17215	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009021	MN -20d	9:19530
17216	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009036	MN -20d	9:19531
17217	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009035	MN -20d	9:19532
17218	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009038	MN -20a	9:19533
17219	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84009040	MN -20d	9:19534
17324	NTIS, PC A05/MF A01 (GPO Dep.)	DE84009383	STD -20	9:19535
17369	NTIS, PC A19/MF A01 (GPO Dep.)	DE84009382	STD -77	9:18450
17381	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84007503	STD -77	9:18451
GAT-T-				
3184	NTIS, PC A02/MF A01	DE83017980	MN -4	9:18821
GEAP-				
25447-2	NTIS (US Sales Only), PC A09/MF A01 (GPO Dep.)	DE84008005	STD -78	9:18427
GEPP-TIS-				
366c	NTIS, PC A14/MF A01 (GPO Dep.)	DE84008362	MN -13	9:19256
786	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007531	MN -13	9:19220
GKSS-				
82/ E/ 54	NTIS (US Sales Only), PC A05/MF A01	DE84750518	MN -80	9:18740
83/ E/ 23	NTIS (US Sales Only), PC A02/MF A01	DE84750861	MN -34C	9:18278
83/ E/ 26	NTIS (US Sales Only), PC A03/MF A01	DE84750857	MN -83	9:18114
83/ E/ 27	NTIS (US Sales Only), PC A03/MF A01	DE84750860	MN -80	9:18489
83/ E/ 28	NTIS (US Sales Only), PC A03/MF A01	DE84750744	MN -78	9:18510
83/ E/ 35	NTIS (US Sales Only), PC A03/MF A01	DE84750748	MN -4	9:18822
83/ E/ 37	NTIS (US Sales Only), PC A04/MF A01	DE84750876	MN -80	9:18490
83/ E/ 44	GKSS-Forschungszentrum Geesthacht, Geesthacht-Tesperhude (Germany, F.R.)			9:19146
GL-				
3566	*See* AD-A-135102/2			9:18891
3628	*See* AD-A-135089/1			9:18890
GRI-				
84/ 0018	*See* ORNL/TM-9009	DE84006847	MN -61C	9:18303
GRS-F-				
127	NTIS (US Sales Only), PC A03/MF A01	DE84750731	MN -80	9:18511
GSF-S-				
861	NTIS (US Sales Only), PC A03/MF A01	DE84750729	MN -48	9:19070
870	Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz		MN -41	9:19201
882	NTIS (US Sales Only), PC A09/MF A01	DE84750738	MN -11	9:19071
935	NTIS (US Sales Only), PC A05/MF A01	DE84750511	MN -48	9:19174
940	NTIS (US Sales Only), PC A04/MF A01	DE84750746	MN -90i	9:19072
GSI-				
83-2	NTIS (US Sales Only), PC A05/MF A01	DE84750509	MN -21	9:19536
83-3	NTIS (US Sales Only), PC A08/MF A01	DE84750514	MN -48	9:19175
83-4	NTIS (US Sales Only), PC A10/MF A01	DE84750508	MN -32	9:18953
83-4-Vol.2	NTIS (US Sales Only), PC A14/MF A01	DE84750735	MN -32	9:19591
83-7	NTIS (US Sales Only), PC A09/MF A01	DE84750736	MN -34C	9:19416
HD-THEP-				
83-2	Library of Heidelberg Univ. (Germany, F.R.)			9:19318
HEDL-SA-				
2842-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006564	MN -79h	9:18455
2927-FP	NTIS (US Sales Only), PC A02/MF A01 (GPO Dep.)	DE84006064	MN -79b	9:19537
2931	NTIS, PC A02/MF A01 (GPO Dep.)	DE84006892	MN -79b	9:18456
2969-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007179	MN -79b	9:18115
3074-S	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008346	MN -79p	9:18512
3078-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007172	MN -80	9:18491
HMI-				
B-397	NTIS (US Sales Only), PC A04/MF A01	DE84750502	MN -98	9:18646
HRP-				
0904719/ 2	NTIS, PC A02/MF A01			9:19150
IA-				
117/ 83	*See* OEFZS-4231	DE84700114	MN -37	9:18981
1383	*See* IAEA-R-2060-F	DE84700708	MN -34C	9:19421
IAE-				
3571/ 2	NTIS (US Sales Only), PC A03/MF A01	DE84700699	MN -34C	9:19394
IAEA-NDS-				
12/ 6	*See* IAEA-R-2061-F	DE84700709	MN -34C	9:19422
IAEA-R-				
2060-F	NTIS (US Sales Only), PC A03/MF A01	DE84700708	MN -34C	9:19421
2061-F	NTIS (US Sales Only), PC A02/MF A01	DE84700709	MN -34C	9:19422
IAEA-SR-				
85/ 13	*See* AECL-8098	DE84900674	MN -11	9:19107

Report No.	Availability	Order No.	Distribution Category	Abstract No.
IAEA-TECDOC-				
291	NTIS (US Sales Only), PC A09/MF A01	DE84780144	MN -11	9:19087
IFE/KR/E-				
82/ 009V	NTIS (US Sales Only), PC A02/MF A01	DE84700103	MN -41	9:19459
IFSR-				
128	*See* DOE/ET/53088-128	DE84008272	MN -20f	9:19490
IFUSP-P-				
351	NTIS (US Sales Only), PC A02/MF A01	DE84700690	MN -46	9:19319
367	NTIS (US Sales Only), PC A03/MF A01	DE84700700	MN -34C	9:19381
368	NTIS (US Sales Only), PC A03/MF A01	DE84700691	MN -46	9:19320
370	NTIS (US Sales Only), PC A03/MF A01	DE84700701	MN -34C	9:19428
372	NTIS (US Sales Only), PC A02/MF A01	DE84700695	MN -34C	9:19429
374	NTIS (US Sales Only), PC A02/MF A01	DE84700696	MN -34C	9:19395
381	NTIS (US Sales Only), PC A03/MF A01	DE84700710	MN -34C	9:19401
393	NTIS (US Sales Only), PC A02/MF A01	DE84700083	MN -4	9:18823
IKE-				
2-61	NTIS (US Sales Only), PC A07/MF A01	DE84750864	MN -80	9:18513
6-125	NTIS (US Sales Only), PC A04/MF A01	DE84750880	MN -78	9:18479
6-142	NTIS (US Sales Only), PC A06/MF A01	DE84750256	MN -48	9:19176
INDC(AUS)-				
9/ L	NTIS (US Sales Only), PC A03/MF A01	DE84700711	MN -34C	9:19402
INDC(CCP)-				
196/ GE	NTIS (US Sales Only), PC A03/MF A01	DE84700712	MN -34C	9:19423
200/ L	NTIS (US Sales Only), PC A02/MF A01	DE84700702	MN -34C	9:19410
INDC(GDR)-				
20	NTIS (US Sales Only), PC A04/MF A01	DE84700713	MN -34C	9:19396
22	NTIS (US Sales Only), PC A04/MF A01	DE84700714	MN -34C	9:19397
INDC(JAP)-				
76/ L	*See* JAERI-M-83-025	DE84700705	MN -34C	9:19435
INDC(NDS)-				
130/ GandP(No.8)	NTIS (US Sales Only), PC A10/MF A01	DE83704522	MN -34C	9:19424
143/ GP(no.9)	NTIS (US Sales Only), PC A08/MF A01	DE84700715	MN -34C	9:19411
INDC(USA)-				
92/ G	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008015	MN -25	9:18275
INIS-mf-				
4754(no.22)	NTIS (US Sales Only), PC A04/MF A01	DE84780109	MN -20	9:19491
8311	NTIS (US Sales Only), PC A09/MF A01	DE84780105	MN -34A	9:18791
8340	NTIS (US Sales Only), PC A06/MF A01	DE84780101	MN -34D	9:19475
8360	NTIS (US Sales Only), PC A06/MF A01	DE84780106	MN -34A	9:18741
8361	NTIS (US Sales Only), PC A05/MF A01	DE84780107	MN -34A	9:18742
8362	NTIS (US Sales Only), PC A21/MF A01	DE84780071	MN -25	9:18470
8366	NTIS (US Sales Only), PC A12/MF A01	DE84780074	MN -41	9:19177
INS-				
447	NTIS (US Sales Only), PC A03/MF A01	DE84700682	MN -34D	9:19375
452	NTIS (US Sales Only), PC A02/MF A01	DE84700703	MN -34C	9:19431
455	NTIS (US Sales Only), PC A02/MF A01	DE84700683	MN -34D	9:19334
IS-T-				
984	NTIS, PC A06/MF A01 (GPO Dep.)	DE84007366	MN -4	9:18883
1076	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84007197	MN -4	9:18863
1090	NTIS, PC A04/MF A01 (GPO Dep.)	DE84007369	MN -25	9:18804
1109	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007370	MN -25	9:18751
1110	NTIS, PC A08/MF A01 (GPO Dep.)	DE84007196	MN -4	9:18843
1111	NTIS, PC A09/MF A01 (GPO Dep.)	DE84007200	MN -4	9:18852
1179	NTIS, PC A04/MF A01 (GPO Dep.)	DE84006640	MN -25	9:18752
IWGFPT-				
1	NTIS (US Sales Only), PC A16; 3	DE84900849	MN -78	9:18428
JAERI-				
1281	NTIS (US Sales Only), PC A03/MF A01	DE84700088	MN -4	9:18870
JAERI-M-				
82-057	NTIS (US Sales Only), PC A05/MF A01	DE84700091	MN -25	9:18805
82-094	NTIS (US Sales Only), PC A06/MF A01	DE84700096	MN -41	9:18514
82-108	NTIS (US Sales Only), PC A03/MF A01	DE84700653	MN -20	9:18276
82-109	NTIS (US Sales Only), PC A03/MF A01	DE84700097	MN -41	9:18485
82-113	NTIS (US Sales Only), PC A02/MF A01	DE84700654	MN -20	9:19500
82-124	NTIS (US Sales Only), PC A03/MF A01	DE84700098	MN -41	9:18515
82-131	NTIS (US Sales Only), PC A03/MF A01	DE84700655	MN -20	9:19544
82-136	NTIS (US Sales Only), PC A03/MF A01	DE84700656	MN -20	9:19545
82-140	NTIS (US Sales Only), PC A03/MF A01	DE84700657	MN -20	9:19546
82-154	NTIS (US Sales Only), PC A10/MF A01	DE84700658	MN -20	9:19547
82-159	NTIS (US Sales Only), PC A09/MF A01	DE84700704	MN -34C	9:19434
82-171	NTIS (US Sales Only), PC A03/MF A01	DE84700659	MN -20	9:19548
82-172	NTIS (US Sales Only), PC A06/MF A01	DE84700660	MN -20	9:19549
82-173	NTIS (US Sales Only), PC A03/MF A01	DE84700661	MN -20	9:19550
82-186	NTIS (US Sales Only), PC A03/MF A01	DE84700662	MN -20	9:19551
82-199	NTIS (US Sales Only), PC A03/MF A01	DE84700692	MN -46	9:19455
82-205	NTIS (US Sales Only), PC A03/MF A01	DE84700663	MN -20	9:19552
82-209	NTIS (US Sales Only), PC A02/MF A01	DE84700664	MN -20	9:19553
82-213	NTIS (US Sales Only), PC A03/MF A01	DE84700665	MN -20	9:19554
82-217	NTIS (US Sales Only), PC A04/MF A01	DE84700666	MN -20	9:19555
83-005	NTIS (US Sales Only), PC A07/MF A01	DE84700667	MN -20	9:19556
83-008	NTIS (US Sales Only), PC A02/MF A01	DE84700668	MN -20	9:19557
83-019	NTIS (US Sales Only), PC A06/MF A01	DE84700697	MN -34C	9:19398
83-025	NTIS (US Sales Only), PC A07/MF A01	DE84700705	MN -34C	9:19435
JINR-				
9-82-866	NTIS (US Sales Only), PC A02/MF A01	DE84700111	MN -23	9:18279

Report No.	Availability	Order No.	Distribution Category	Abstract No.
E-1-82-516	NTIS (US Sales Only), PC A02/MF A01	DE84700079	MN -34C	9:19387
E-1-82-760	NTIS (US Sales Only), PC A02/MF A01	DE84700689	MN -34D	9:19293
E-4-82-189	NTIS (US Sales Only), PC A02/MF A01	DE84700706	MN -34C	9:19382
E-4-82-726	NTIS (US Sales Only), PC A02/MF A01	DE84700707	MN -34C	9:19438
JINR-R-				
16-82-629	NTIS (US Sales Only), PC A02/MF A01	DE84700693	MN -46	9:19439
Juel-				
1610	NTIS (US Sales Only), PC A07/MF A01	DE84750747	MN -2	9:18116
1850	NTIS (US Sales Only), PC A07/MF A01	DE84750893	MN -25	9:18853
1853	NTIS (US Sales Only), PC A10/MF A01	DE84750878	MN -77	9:18480
1854	NTIS (US Sales Only), PC A03/MF A01	DE84750503	MN -11	9:19030
1859	NTIS (US Sales Only), PC A04/MF A01	DE84750877	MN -34C	9:19440
Juel-Spez-				
148	NTIS (US Sales Only), PC A05/MF A01	DE84750516	MN -2	9:18169
199	NTIS (US Sales Only), PC A11/MF A01	DE84750745	MN -80	9:18516
200	NTIS (US Sales Only), PC A02/MF A01	DE84750730	MN -80	9:18754
201	NTIS (US Sales Only), PC A03/MF A01	DE84750510	MN -70	9:18170
212	NTIS (US Sales Only), PC A04/MF A01	DE84750863	MN -77	9:18517
K-DSA-				
991	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007472	MN -41	9:18107
K/HS-				
26	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007576	MN -41	9:18262
K/OA-				
5580	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007683	MN -15	9:18268
5615	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007589	MN -16	9:18269
K/P-				
6790	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84008007	MN -41	9:18108
6791	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007473	MN -41	9:19221
K/PS-				
5026	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007960	MN -12	9:18927
KAERI/MR-				
35/ 82	NTIS (US Sales Only), PC A04/MF A01	DE84700115	MN -23	9:18280
37/ 82	NTIS (US Sales Only), PC A04/MF A01	DE84700095	MN -23	9:19178
43/ 82	NTIS (US Sales Only), PC A02/MF A01	DE84700110	MN -22	9:18277
KAERI/RR-				
351/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84700092	MN -34B	9:19054
353/ 82	NTIS (US Sales Only), PC A04/MF A01	DE84700084	MN -4	9:18824
354/ 82	NTIS (US Sales Only), PC A04/MF A01	DE84700089	MN -4	9:18783
358/ 82	NTIS (US Sales Only), PC A24/MF A01	DE84780090	MN -10	9:18106
360/ 82	NTIS (US Sales Only), PC A09/MF A01	DE84780091	MN -48	9:19180
361/ 82	NTIS (US Sales Only), PC A06/MF A01	DE84700099	MN -41	9:18486
362/ 82	NTIS (US Sales Only), PC A07/MF A01	DE84700100	MN -41	9:18518
371/ 82	NTIS (US Sales Only), PC A03/MF A01	DE84700094	MN -48	9:19181
377/ 82	NTIS (US Sales Only), PC A17/MF A01	DE84780088	MN -80	9:18476
380/ 82	NTIS (US Sales Only), PC A13/MF A01	DE84700101	MN -41	9:18487
382/ 82	NTIS (US Sales Only), PC A06/MF A01	DE84700102	MN -41	9:18519
KEH/R-				
83-96	NTIS, PC A08; 3 (GPO Dep.)	DE84009310	MN -85	9:18171
KFA-ASS-				
0372	Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)			9:19579
KFK-				
3351	NTIS (US Sales Only), PC A03/MF A01	DE84750742	MN -4	9:18825
3374-B	Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.)			9:18775
3460	NTIS (US Sales Only), PC A06/MF A01	DE84750734	MN -4	9:18121
3507	NTIS (US Sales Only), PC A04/MF A01	DE84750874	MN -78	9:18520
3516	NTIS (US Sales Only), PC A04/MF A01	DE84750255	MN -34C	9:19403
3517	NTIS (US Sales Only), PC A08/MF A01	DE84750743	MN -4	9:18122
3523	Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.			9:17989
3554	NTIS (US Sales Only), PC A04/MF A01	DE84750871	MN -80	9:18469
3558	NTIS (US Sales Only), PC A06/MF A01	DE84750873	MN -32	9:19592
3571	NTIS (US Sales Only), PC A11/MF A01	DE84750872	MN -25	9:18755
3576	NTIS (US Sales Only), PC A03/MF A01	DE84750859	MN -28	9:18896
3580	NTIS (US Sales Only), PC A03/MF A01	DE84750517	MN -34C	9:18979
3582	NTIS (US Sales Only), PC A03/MF A01	DE84750740	MN -34C	9:19407
3583	NTIS (US Sales Only), PC A03/MF A01	DE84750885	MN -25	9:18776
3586	NTIS (US Sales Only), PC A02/MF A01	DE84750737	MN -34C	9:19441
3593	NTIS (US Sales Only), PC A05/MF A01	DE84750886	MN -38	9:18928
3594	NTIS (US Sales Only), PC A04/MF A01	DE84750882	MN -78	9:18445
3602	NTIS (US Sales Only), PC A04/MF A01	DE84750884	MN -80	9:18756
KFK-AFR-				
007	NTIS (US Sales Only), PC A04/MF A01	DE84750862	MN -11	9:19031
KFKI-				
1983-47	NTIS (US Sales Only), PC A02/MF A01	DE84700109	MN -41	9:19460
KIYI-				
81-10	NTIS (US Sales Only), PC A04/MF A01	DE84780048	MN -37	9:18980
KMU-HEP-				
82-02	NTIS (US Sales Only), PC A02/MF A01	DE84700684	MN -34D	9:19344
83-01	NTIS (US Sales Only), PC A03/MF A01	DE84700685	MN -34D	9:19345
83-02	NTIS (US Sales Only), PC A02/MF A01	DE84700686	MN -34D	9:19346
83-03	NTIS (US Sales Only), PC A02/MF A01	DE84700687	MN -34D	9:19347
KTA-GS-				
40	NTIS (US Sales Only), PC A04/MF A01	DE84750739	MN -2	9:18649
LA-				
9846-PR	NTIS, PC A06/MF A01 (GPO Dep.)	DE84007991	STD -70	9:18172

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9872-MS	NTIS, PC A05/MF A01 (GPO Dep.)	DE84008006	STD -34	9:19501
9896-PR	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008358	STD -11	9:19109
9908	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008001	STD -34	9:19558
9932-T	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84008368	STD -34C	9:19388
9942	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE84008004	STD -15	9:18270
9947-T	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84007990	STD -34C	9:19404
9950-MS	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008369	STD -4	9:18826
9960-T	NTIS, PC A11/MF A01 (GPO Dep.)	DE84008367	STD -34C	9:19389
9969-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008364	STD -32	9:19269
9970-T	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84008366	STD -34C	9:19390
9971-MS	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008365	STD -34C	9:19383
9984-T	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84008370	STD -66e	9:18388
9987	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008371	STD -4	9:18845
10000-PR	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007989	STD -33A	9:18672
10011-PR	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008372	STD -11	9:19061
10027-MS	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008282	STD -13	9:19580
LA-UR-				
83-2150	NTIS, PC A03; 3 (GPO Dep.)	DE83015221	MN -34C	9:19456
84-200	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84006023	MN -15	9:18173
84-429	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007505	MN -48	9:19593
84-431	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007501	MN -34A	9:19263
84-512	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007500	MN -34B	9:19249
84-583	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007487	MN -20f	9:19502
84-584	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007482	MN -20f	9:19503
84-601	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007488	MN -20f	9:19504
84-602	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007489	MN -20f	9:19559
84-603	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007476	MN -20f	9:19560
84-606	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007483	MN -21	9:19561
84-644	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007465	MN -34D	9:19348
84-650	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007468	MN -32	9:19594
84-711	NTIS, PC A03/MF A01 (GPO Dep.)	DE84007469	MN -4	9:18827
84-714	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84007470	MN -20b	9:19562
84-720	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007479	MN -25	9:18994
LAL-RT-				
83-01	NTIS (US Sales Only), PC A02/MF A01	DE84700122	MN -28	9:18961
83-02	NTIS (US Sales Only), PC A02/MF A01	DE84700123	MN -28	9:18962
83-03	NTIS (US Sales Only), PC A02/MF A01	DE84700124	MN -28	9:18955
83-04	NTIS (US Sales Only), PC A02/MF A01	DE84700125	MN -28	9:18963
LALP-				
83-47	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84007995	MN -34C	9:19483
LAPP-TH-				
87	*See* DESY-83-093	DE84750897	MN -34D	9:19313
88	*See* DESY-83-094	DE84750898	MN -34D	9:19314
LBL-				
14810	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008162	MN -32	9:19595
15075	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008008	MN -11	9:18641
15998	NTIS, PC A07/MF A01 (GPO Dep.)	DE84008256	MN -60	9:18392
16262	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008247	MN -25	9:18757
16535	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008250	MN -25	9:18897
16672	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008253	MN -66a	9:18386
16695	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008248	MN -25	9:18995
16846	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008236	MN -34D	9:19376
16968	NTIS, PC A09/MF A01 (GPO Dep.)	DE84007962	MN -4	9:19264
17020	NTIS, PC A03; 3 (GPO Dep.)	DE84006767	MN -28	9:18947
17058	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84008245	MN -94c	9:18631
17130	NTIS, PC A03/MF A01 (GPO Dep.)	DE84009385	STD -41	9:19032
17221	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008249	MN -92a	9:18048
17223	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84008345	MN -4	9:18846
17244	NTIS, PC A12/MF A01 (GPO Dep.)	DE84007974	MN -38	9:18929
17279	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84008246	MN -34B	9:19240
17282	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84007975	MN -34A	9:19265
17313	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84008165	MN -48	9:19153
17366	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009236	MN -48	9:19131
17368	NTIS, PC A02/MF A01 (GPO Dep.)	DE84009213	MN -61G	9:18302
17377	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008279	MN -11	9:18931
LYCEN-				
8220	NTIS (US Sales Only), PC A04/MF A01	DE84700080	MN -34C	9:19418
MCR-				
77-161	*See* DOE/ET/20422-3	DE84006572	MN -62c	9:18368
MINTEK-M-				
53	NTIS (US Sales Only), PC A03/MF A01	DE84700085	MN -4	9:18828
MPI-PAE/Exp.El.-				
122	Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)			9:19298
123	Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)			9:19405
MPQ-				
75	Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)			9:19505
76	Max-Planck-Institut fuer Quantenoptik, Garching (Germany, F.R.)			9:19563
NASA-CR-				
159762-Vol.4	*See* DOE/NASA/0030-80/4	DE84009069	MN -93	9:18400
168203	*See* DOE/NASA/0291-1	DE84007582	STD -93	9:18675
168309	*See* DOE/NASA/0241-12	DE84006738	MN -93	9:18674

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NASA-TM-X-				
2950	NTIS, PC A03; 3	DE84900884	MN -80	9:18461
NBSIR-				
83-2698	*See* PB-84-140508			9:19105
83-2790	*See* PB-84-136175			9:18762
NDRL-				
2517	*See* DOE/ER/00038-2517	DE84007396	MN -4	9:18868
2537	*See* DOE/ER/00038-2537	DE84009058	MN -4	9:18869
NE-E-				
13-6T-Rev.	Nuclear Standards Management Center, Oak Ridge, TN 37831		STD -79Tb	9:18457
13-7T-Rev.	Nuclear Standards Management Center, PO Box Y, Oak Ridge, TN 37831		STD -79Tb	9:18452
NE-M-				
14-2T-Rev.	Nuclear Standards Management Center, Oak Ridge, TN 37831		STD -79T	9:18458
NEANDC(J)-				
89/ U	*See* JAERI-M-83-025	DE84700705	MN -34C	9:19435
NEANDC(US)-				
217/ A	*See* INDC(USA)-92/G	DE84008015	MN -25	9:18275
NIIEFA-P-B-				
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4900854	NTIS, PC A05/MF A01; 1	DE84900854	MN -13	9:19581
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3666	NTIS, PC A08/MF A01; 1 - GPO $5.50	DE84900873	MN -80	9:18492
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273	NTIS, PC A03/MF A01 (GPO Dep.)	DE84008210	MN -11	9:19076
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83-40122/ 1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84007799	MN -95d	9:18694
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8265	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84008212	STD -41	9:19182
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8990	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE84009115	MN -70	9:18255
9005	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007599	STD -41	9:19019
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4900518	NTIS, PC A03/MF A01	DE84900518	MN -11	9:18636
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84-135789	NTIS, PC A05/MF A01			9:19066
84-135912	Pub. in Proceedings of International Conference on Nuclear Data Science Technology Held at Antwerp (Belgium) on September 6-10, 1982, p456-459 1983.			9:19425
84-136175	NTIS, PC A03/MF A01			9:18762
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4209	*See* NUREG/CR-3503	DE84005648	MN -41	9:18441
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4883	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE84008359	MN -95f	9:18714
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4914	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009033	MN -60	9:18394
4962	NTIS, PC A07/MF A01 (GPO Dep.)	DE84007551	MN -90d	9:17963
4963	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84009023	MN -70	9:18179
4976	NTIS, PC A12/MF A01; 1	DE84007968	MN -46	9:18124
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10227	NTIS, PC A02/MF A01 (GPO Dep.)	DE84008322	MN -32	9:19601
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11680	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84008302	MN -70A	9:18180
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3589	NTIS, PC A02/MF A01 (GPO Dep.)	DE84007334	STD -10	9:18184
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191	NTIS (US Sales Only), PC AA03/MF A01	DE84900758	MN -32	9:19482
192	NTIS (US Sales Only), PC AA03/MF A01	DE84900759	MN -32	9:19597
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4778	NTIS (US Sales Only), PC A02/MF A01	DE84900798	MN -38	9:18907
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4797	NTIS (US Sales Only), PC A02/MF A01	DE84900802	MN -85	9:18908
4800	NTIS (US Sales Only), PC A02/MF A01	DE84900809	MN -85	9:18909
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2270	NTIS (US Sales Only), PC A03/MF A01	DE84700107	MN -41	9:18903
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UG Uganda
US United States of America (USA)
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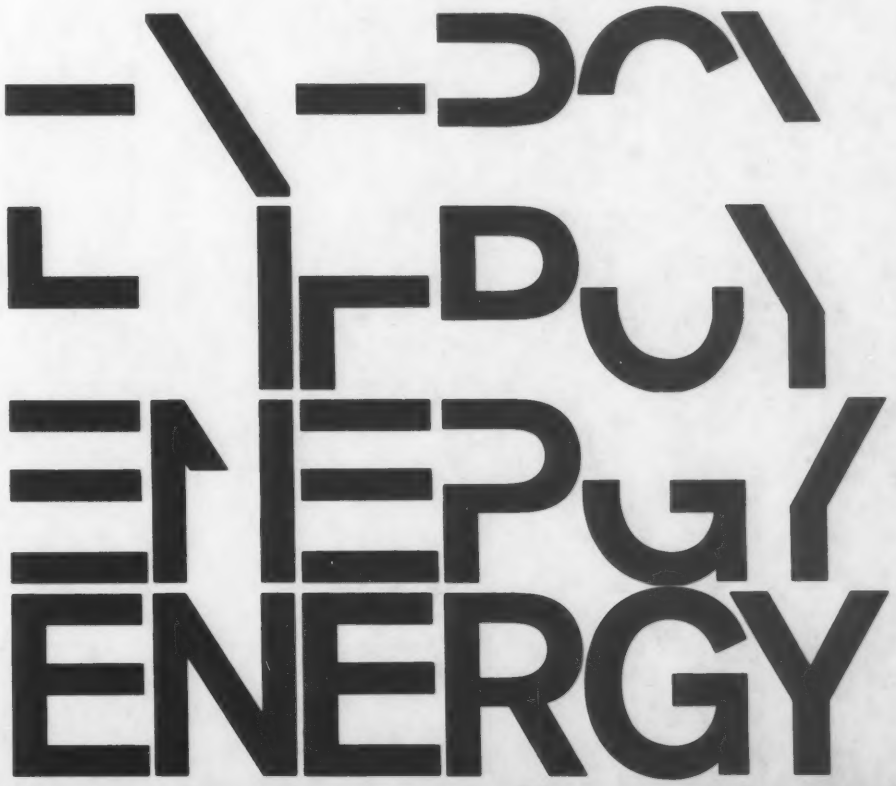

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Documents Department
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Madison, WI 53706
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